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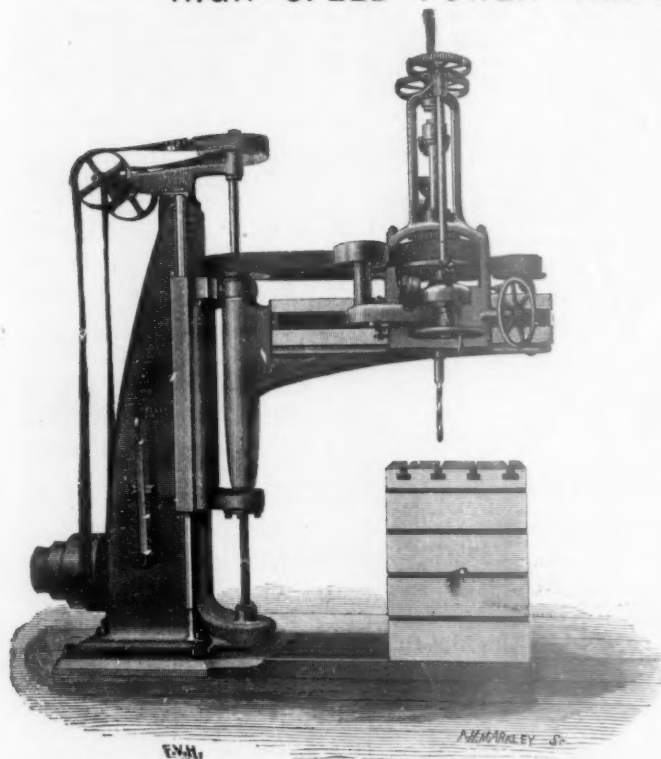
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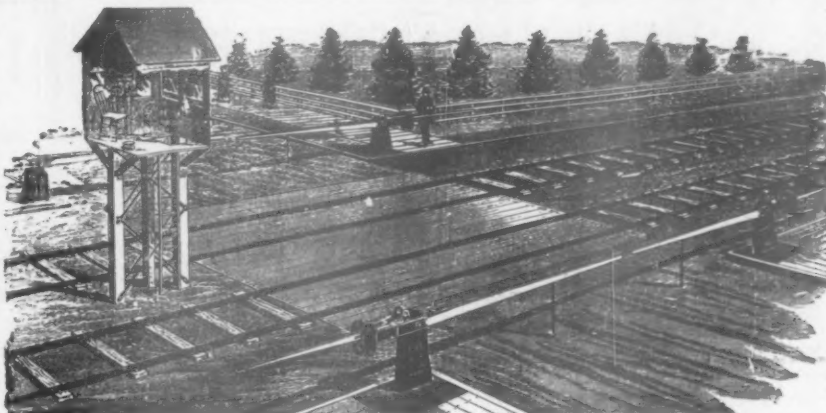
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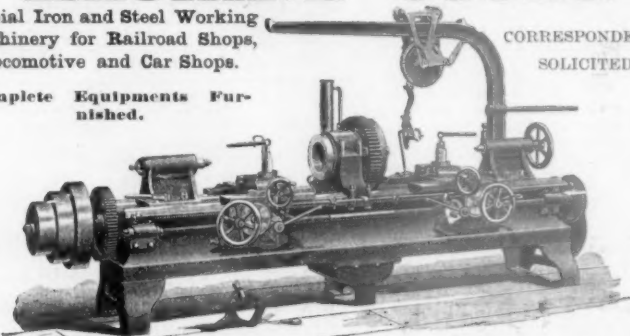
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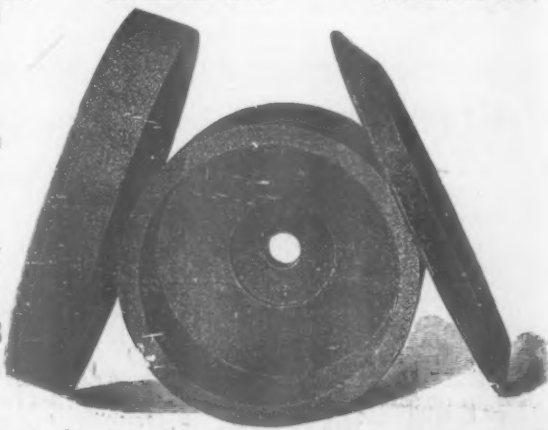
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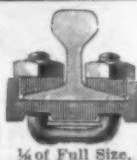
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ALPHABETICAL INDEX TO ADVERTISEMENTS.

(Classified Index on the next page.)

Abendroth & Root Mfg. Co.	XXXIV	C. C. & St. L. Ry.	XXXV	Gates Iron Wks.	XXVI	Lima Mach. ne Works.	XXXVI	Passaic Rolling Mill Co.	XXXVIII	Smith, Edw., & Co.	XXII
Acme Machy. Co.	VIII	C. H. & D. Ry.	XXXV	Gilbert, Bradford L.	XXVI	Link Belt Engineering Co.	XXVI	Pedrick & Ayer	IX	Su. H. F. H.	XXII
Adams, Oliver	VIII	C. M. & St. P. Ry.	XXXV	Gill-Alexander El. Mfg. Co.	XXVII	Link Belt Machy. Co.	XXVI	Pearless Rubber Co.	VI	Sold Steel Co.	XXIV
Adams & Westlake Co.	IX	C. R. L. & P. Ry.	XXXV	Gold Car Heating Co.	XXVI	Lodell Car Wheel Co.	XXXI	Pennsylvania R. R.	XXXV	Soosmith & Co.	XL
Alax Metal Co.	XXXVI	Chicago & Alton R. R.	XXXV	Goodwin, J. B.	V	Long & Allstatter Co.	XXVI	Pennsylvania Steel Co., N.Y.	J	South Baltimore Car Works.	XXVI
Allen Paper Car Wheel Co.	XXX	Chicago & N. W. Ry.	XXXV	Gould & Eberhardt	XXIX	Louis. Bridge & Iron Wks.	XXVI	Pennsylvania Steel Co., Pa.	XXI	Southern, Jno. & Co.	XXVII
Alentown Rolling Mills.	XXX	Childe, O. W., & Co.	J	Gould & Eberhardt	XXIX	Louis. Car Wheel Ry. Sup. Co.	XXII	Perry Ventilator Co.	XXVIII	Southern & Pac. Refrigerator	XXVII
Allison Mfg. Co.	XXXVI	Cleveland City Forge & Iron Co.	J	Grand Union Hotel.	XXXIV	Louisville Steam Forge Co.	XXVI	Peters, G. D. & Co.	I	Car Co.	XXVI
Am. Cont. Draw-Bar Co.	XXVII	Cleveland Frog & Cross Co.	XL	Greenlee Bros. & Co.	IX	Lucius, Albert	I	Philadelphia Bridge Wks.	XXI	Spon, E. & F. N., & Co.	XXVI
American Fluoride Co.	VI	Condon Brake Shoe Co.	XXVII	Guarantee Co., N. Y.	XXVI	Lukens Iron & Steel Co.	XXVI	Phila. Engineer Wks., La.	XXIX	Sprague, James & Hutchinson.	XXII
American Steel Wheel Co.	XXX	Connelly, J. T.	XXVI	Hale & Kilburn Mfg. Co.	XXVII	Males, A. S. & Co.	XXVI	Phoenix Bridge Co.	XXVIII	Springfield Iron Co.	XXVIII
American Washer & Mfg. Co.	VII	Consolidated Car Heating Co.	XXV	Hall Signal Co.	XXIX	Manning, Maxwell & Moore	VIII	Phosphor Bronze Smelting Co.,	Lid	Standard Car Coup Co., X & XXVIII	XXVI
Anderson & Burr.	XXXIX	Cont. Rail Joint Co. of Amer.	XXIX	Hammitt, M. C.	XXVII	Marion Steam Shovel Co.	XXVII	Lid	XXVI	Standard Nut Lock Co.	XXIV
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Baldwin Loco. Wks.	XXVIII	Detroit Bridge & Iron Wks.	XXII	Hilf, E. W. & Co.	XXII	Michigan Central Ry.	XXVII	Pottsville Bridge Co.	XXXIX	Taylor Iron & Steel Co.	XXI
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Bowling & Co.	XXIII	Dixie Car Co.	XXVII	Co.	XXII	Natl. Valve Washer Co.	XXIV	Royal Ins. Co.	XXII	Wants and For Sale.	XXII
Bradley, Osgood & Son.	XXIII	Dixie Car Co.	XXVII	Johnston, R. R., Fr. & S. Co.	XXII	Natl. Valve Washer Co.	XXIV	St. Louis Car Coupler Co.	XXVII	Washington Car Wheel Co.	XXII
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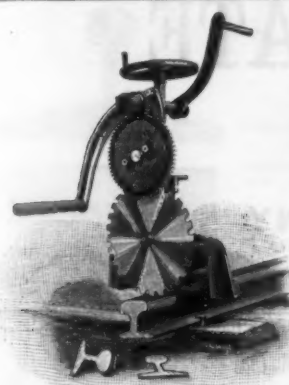
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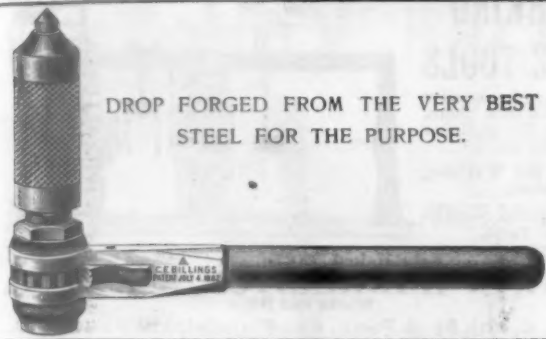
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A Resilient Spiral Spring Washer with Ratchet-Shaped Teeth.

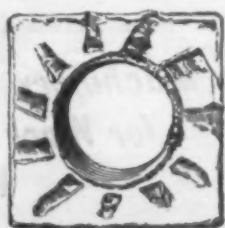
Patented.

The American Harvey No. 1 Nut Lock, a resilient spring washer with chisel cutting edges. Patented. Tempered in oil.

SQUARE.



The American "No. 2 Square" Plain Spring, answers the purpose of all ordinary spring washers. Above pattern made of either round or square steel. Tempered in oil.



Our claim for this lock, aside from the unexcelled spring quality it possesses (being tempered in oil) is the tangential cutting or ratchet ribs on either side, and, reversed, so that when the nut is set down these ribs are embedded in both fish plate and under face of nut to such extent that a removal of the nut by force (and it can only be done with force) will show angular grooves plowed on surface of both nut and fish plate (see cuts above) without disturbing the thread of either nut or bolt, both of which, together with the nut lock, can be used again. This is a positive lock, with spring temper, and will not cut thread of nut or bolt.

CORRESPONDENCE AND ORDERS SOLICITED. SAMPLES FURNISHED FREE ON APPLICATION AND SENT TO ANY ADDRESS.

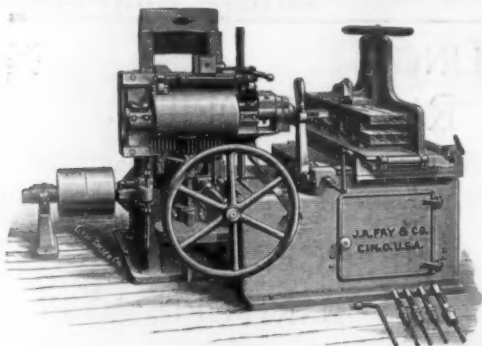
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Complete Equipments

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No. 3 New Improved Hollow Chisel Car Mortiser.

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Cutting from 1/4 in. to 6 in. diam.

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This cut shows the shape of the U. S.
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EVERY TOOL WARRANTED.

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Established 1864. New Bedford, Mass.

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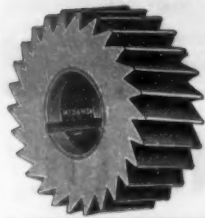
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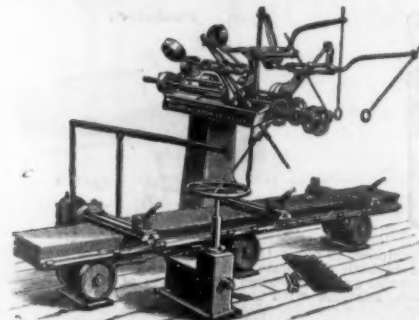
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Car Builders' Tools a Specialty.

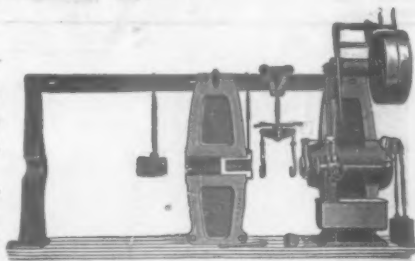


Three-Spindle Universal Vertical Boring Machine.

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METAL-WORKING**MACHINE TOOLS**For Railroad Shops, Locomotive
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Steam Forges, Ship Yards, Boiler
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Established 1867.

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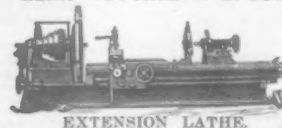
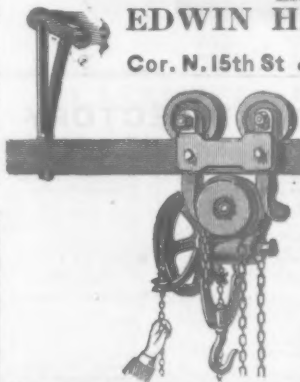
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Extension and Gap Lathes, Planers with Quick
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IMPROVED ENGINE SPRINGS

EVERY SPRING GUARANTEED.

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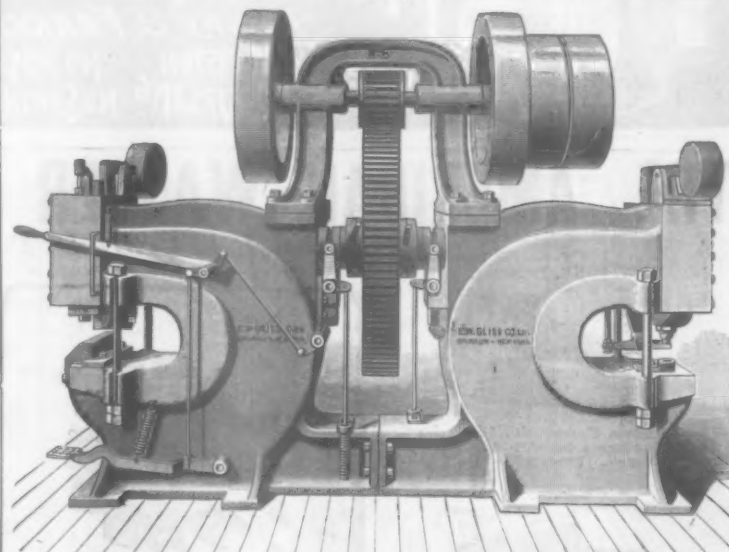
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No. 6 COMBINED PUNCH AND SHEAR.

Made in 10 Sizes, with Throats from 6 to 48 inches.

We Make Foot and Power Tools of All Kinds for Punching, Per-
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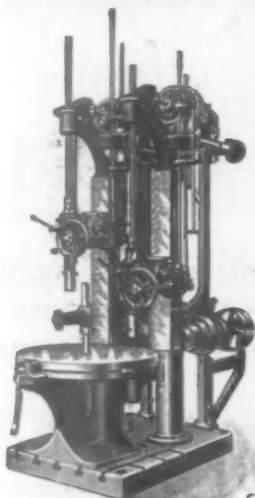
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A useful and rapid working machine for facing connecting and parallel rod Brasses. It has an adjustable chuck that catches the Brass same as the strap does, and holds it as held on the pin. Accurate work done without the use of files.

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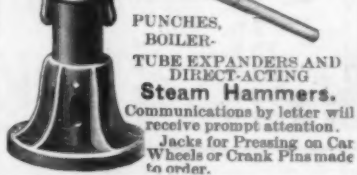
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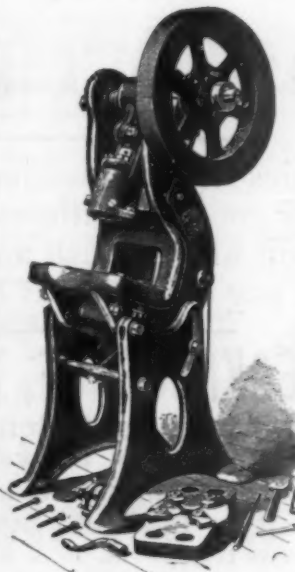
TANGVE'S HYDRAULIC LIFTING JACK.



A good, reliable jack for lifting or pushing in any direction. The lever is for pumping it up, the key lowers and stops it at any point, when it is again ready for lifting, saving time and trouble. Various sizes made, from 4 tons to 200 tons.

Joseph F. McCoy Co.
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NEW YORK.

Large Special "PUNCHES" and "SHEARERS"
for Bridge and Girder Work, Iron
Buildings, etc., etc.



Foot Screw and Drop. Also Cutting,
Punching, Forming, Shearing,
Embossing, Coining
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PRESSES

OF ALL SIZES AND KINDS.

DRAWING PRESSES and DIES

For Lanterns, Lamps, Tinware,
Brass Goods, etc.

HYDRAULIC JACKS.



TO LIFT
TO PUSH
TO PULL



All sizes. All styles. All warranted.
Hydraulic Transfer Jacks
For Removing Locomotive Drivers in
27 Minutes.

Car Wheel Presses. Crank Pin Presses.
Send for Catalogue.

WATSON & STILLMAN,
204-210 E. Forty-third St., New York.

MICHIGAN FORCE & IRON CO.,

No. 1 Newberry Bldg., Detroit, Mich.,
Manufacturers of

MERCHANT BAR IRON.

And all Kinds of

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STANDARD
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DUPLEX
STEAM PUMP.

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PUMPS OF EVERY
DESCRIPTION.

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Manufacturers of all kinds of Presses, Dies and other Tools
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Please Send for their Illustrated Price Lists, describing 150
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WOOD WORKING
MACHINERY.**

SEND FOR DESCRIPTION OF OUR NEW

AUTOMATIC CAR MORTISERS, AND FOUR SPINDLE
CAR GAINER. BORING MACHINE.
DOUBLE CUT OFF MACHINE.

CHICAGO.

Which of these Couplers is better adapted to withstand the shocks and strains of the present 60,000-lb. cars? and which for the heavier rolling stock of the future?

DROP TESTS WITH 1,640 lbs. WEIGHT.

ONE DESIGN OF THE PIVOT TYPE.

TEST NO. 1.

5 ft. blow. Knuckle closed 3-8 inch Pivot pin slightly bent.
7 " " 1-2 " " badly bent.
9 " " 7-8 " " Punched hole through back and side of drawhead at buifing point. Knuckle and pivot pin useless.

TEST NO. 2.

11 ft. blow. Guide arm, both lugs, back and shank of drawhead broken.

TEST NO. 3.

18 ft. blow. Knuckle, drawhead, lock, pivot broken in many pieces.

M. C. B. DOWLING TYPE.

TEST NO. 1.

1st drop, 18 ft. Uninjured.
2d " 18 ft.
3d " 18 ft. Shank bent 3-16.

TEST NO. 2.

1 blow, 5 ft. Uninjured.
1 " 7 ft. "
1 " 9 ft. "
1 " 20 ft. Knuckle closed in 1-8 inch.
1 " 22 ft. Shank of drawhead bent 1-16 inch.
2d at 22 ft. Knuckle broke at pivot circle. Drawhead broke mid-way in shank.

TEST NO. 3.

1 blow, 5 ft. Uninjured.
1 " 7 ft. "
1 " 9 ft. "
1 " 20 ft. "
1 " 22 ft. "
2d at 22 ft. "
3d at 22 ft. "

To Railway Companies who are willing to make similar comparative tests, we will furnish from our stock our couplers without charge, or if taken from cars in service we will replace them. We will also furnish a sufficient number of this pivot type to make tests, without charge, and pay all expenses of the tests.

CAUSES OF WEAKNESS OF THIS DESIGN OF PIVOT TYPE.

- 1st. 36 1-2 lbs. of steel is not sufficient material to make a strong knuckle.
- 2d. Vertical slack 1 1-2 inches between a knuckle and a drawhead, at the pivot, must necessarily cause weakness—it is a defect.
- 3d. A guard arm that is half cut away by a lock cannot be expected to withstand a drop test.

Reasons for the Superior Strength of the Dowling Type.

- 1st. 60 lbs. forged steel knuckle.
- 2d. No pivot pin or pivot lugs.
- 3d. A full guard arm with extra backing ribs.

		Percentages of Breakages.	Life.	Cost of Maintenance Replacing Drawheads at \$4 and Knuckles at \$1.	Cost of Maintenance per Car per Year.
ONE OF THE PIVOTED TYPE.	11,861 Couplers for 1 year on basis 10 mos. records.	Heads, 27 $\frac{81}{100}$ % Knuckles, 54 $\frac{50}{100}$ %	Heads, 3 yrs. 6 mos. Knuckles, 1 yr. 9 mos.	\$19,500.00	\$3.32
STANDARD DOWLING TYPE.	10,676 Couplers for 1 year on basis 14 mos. records.	Heads, 3 $\frac{20}{100}$ % Knuckles, 12 $\frac{54}{100}$ %	Heads, 30 years. Knuckles, 8 years.	\$2,788.28	\$0.52

Our facilities for manufacture enable us to furnish this coupler with malleable iron drawhead, forged steel knuckle and lock, at a slight advance on the price of the material in open market, and to meet the guarantees of competing companies.

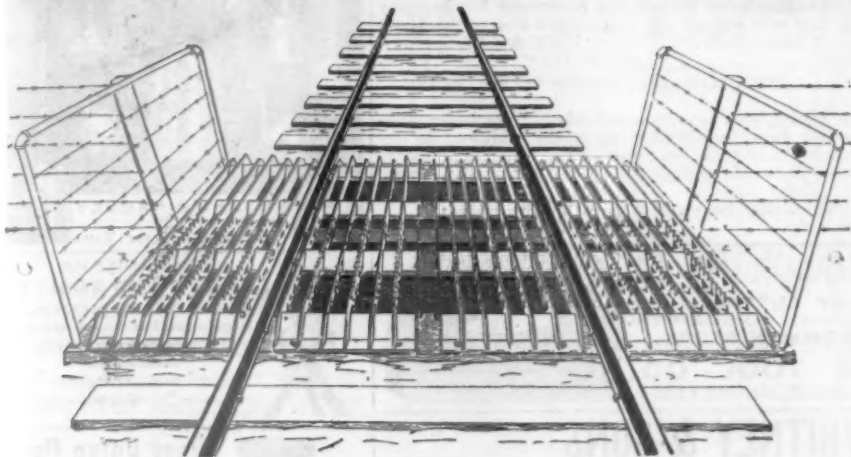
We will also furnish cast steel drawheads in place of malleable iron at the difference in cost.

THE STANDARD CAR COUPLING CO.,

New York Office: 45 BROADWAY.

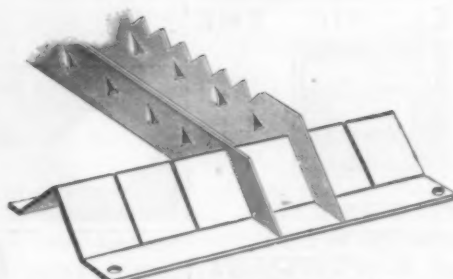
Chicago Office: 1018 THE BROOKERY.

THE NATIONAL SURFACE GUARD CO.



No. 4.

J. T. HALL, Gen. Mgr. and Treas.
T. M. FISH, Vice-Pres. and Sec'y.



Broken Section No. 4.

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15,000 IN USE ON 170 RAILROADS

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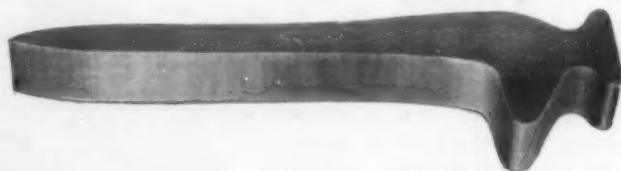
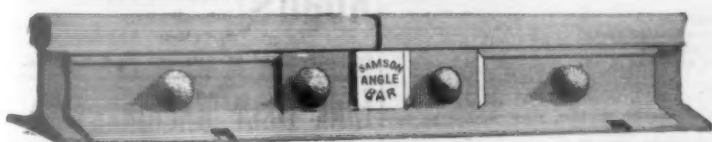
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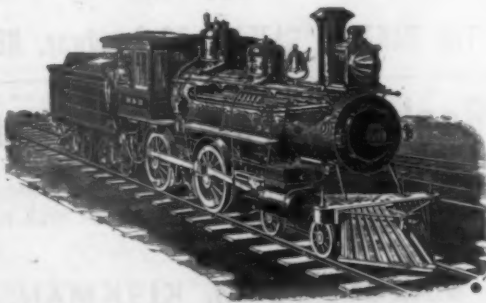
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To whom it may Concern:

We have this day sold to THE DAYTON MFG. CO., of Dayton, Ohio, and turned over to them our entire Railroad Business, including Railroad Supplies Materials, Patterns, Tools, Patents and "Good Will." The Dayton Mfg. Co. will complete all unfilled orders on our books.

We take this opportunity to thank our friends and customers for the many favors accorded us, and hope they will extend the same courtesies to the above firm.

M. SIERSDORFER, Sec'y.

POST & CO.,
By ISAAC KINSEY, Pres't.

OFFICE OF DAYTON MFG. CO., DAYTON, O., Feb. 18, 1892.

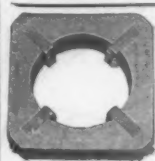
To our Customers and Friends:

The above arrangement having been consummated this day, we desire to announce, that with the increased facilities afforded us by the addition, to our own, of the large stock of Post & Co. of both manufactured and raw material, as well as patterns, tools, &c., we will be able promptly to supply our customers with everything in our line.

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 - V. Railway rates; discrimination; pools.
 - VI. Special rates and their relation to commerce.
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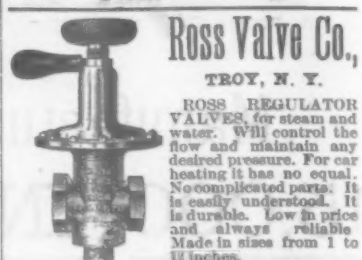
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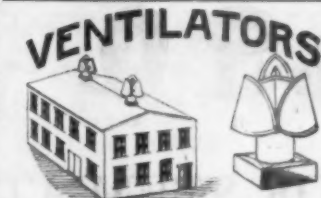
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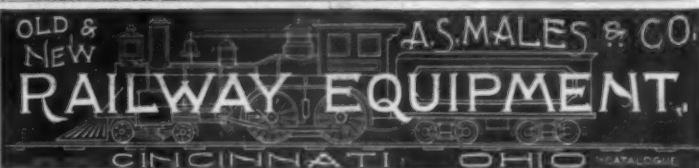
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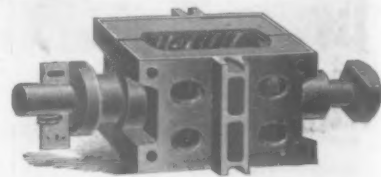
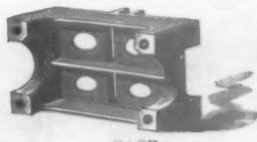
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OUR APPARATUS IS IN SUCCESSFUL OPERATION ON 45 ROADS.

IT PAYS FOR ITSELF.

Individual Continuous-Ringing Telegraph Call

—WITH—

AUTOMATIC ANSWER BACK.

MODEL OF 1892.

ELECTRIC SECRET SERVICE COMPANY,

45 BROADWAY, NEW YORK.

C. P. MACKIE, Gen. Man.

S. S. BOGART, Gen. Agent.

J. W. LATTIG, Gen. Supt.

NATIONAL PAINT WORKS,

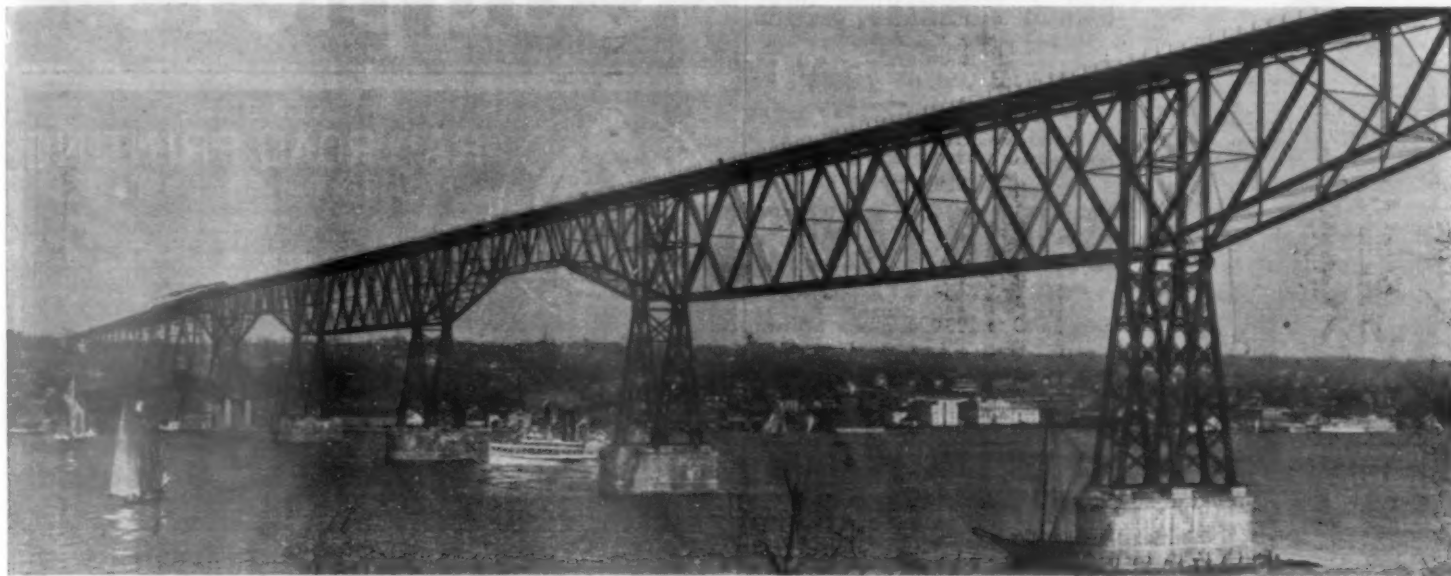
WILLIAMSPORT, PA.,
—THE ONLY MANUFACTURERS OF—

ELLIOTT'S ASPHALTUM PAINTS,

IN ALL COLORS. MIXED READY FOR USE.

THE RECOGNIZED STANDARD FOR QUALITY.

SALES IN 1879, 1,000 BARRELS. SALES IN 1889, OVER 10,000 BARRELS.



POUGHKEEPSIE BRIDGE, BUILT BY UNION BRIDGE CO., PAINTED WITH ELLIOTT'S ASPHALTUM, NO. 31.

In the preparation of our paints we use only the very best Lead, Zinc, Minerals, Coloring Materials and Crude Asphaltum, ground in and thinned with PURE LINSEED OIL.

ARE NOT AFFECTED BY THE GASES AND ACIDS RESULTING FROM COMBUSTION OF COAL.

WORK FREELY AND EVENLY WITH A FINISH EQUAL TO THAT OF VARNISHED WORK.

ARE CHEAPER AND AS DURABLE AS ANY FIRST CLASS PAINT IN THE MARKET.

A NON-CONDUCTOR OF HEAT AND WILL STAND 300 DEGREES.

Ten Years' practical experience with our Paints has resulted in their use and adoption as the standard for quality by nearly all of the leading railroads of the country, Bridge Builders, Iron Works, Car Works, and corporation trade generally.

Are Unsurpassed for Depots, Freight Cars, Bridges (wood or iron), Tin or Iron Roofs, Water Tanks, Houses, Barns, Vessels, etc., etc.

To show the popularity of our goods, we mention a few of our customers and a few large structures painted with our Paint:

Central Viaduct, Cleveland, O.
N. Y. C. & St. L. R. R. Viaduct, Cleve., O.
New C. O. R. R. Bridge, Cincinnati, O.
Poughkeepsie Bridge.
New London Draw Bridge.
Denver Cable Road.
Cantilever Bridge, Niagara Falls.
Harvard Bridge, Boston, Mass.
U. S. Gov. Heavy Ordnance Works.

Union Bridge Co.
Phoenix Bridge Co.
Keystone Bridge Co.
Edge Moor Bridge Works.
Pencoyd Iron Works.
Passaic Rolling Mill Co.
Standard Oil Co.
New York Central & H. R. R. R. Co.
Boston & Albany R. R.

Boston & Maine R. R.
N. Y., N. H. & Hartford R. R.
Pennsylvania R. R.
Richmond & Danville R. R.
Atlantic Coast Line.
East Tenn., Va. & Georgia R. R.
Texas Pacific R. R.
Illinois Central R. R.
Chi. & Northwestern R. R.

Chi., Bur. & Quincy R. R.
Louisville & Nashville R. R.
Ohio & Miss. R. R.
Col., H. V. & Tol. R. R.
Lake Shore & M. S. R. R.
Western N. Y. & Pa. R. R.
Southern Pacific R. R.
A., T. & S. Fé R. R.
Missouri Pacific R. R.

Samples, Price-Lists and References from those who have used and are now using these paints in your vicinity furnished on application.

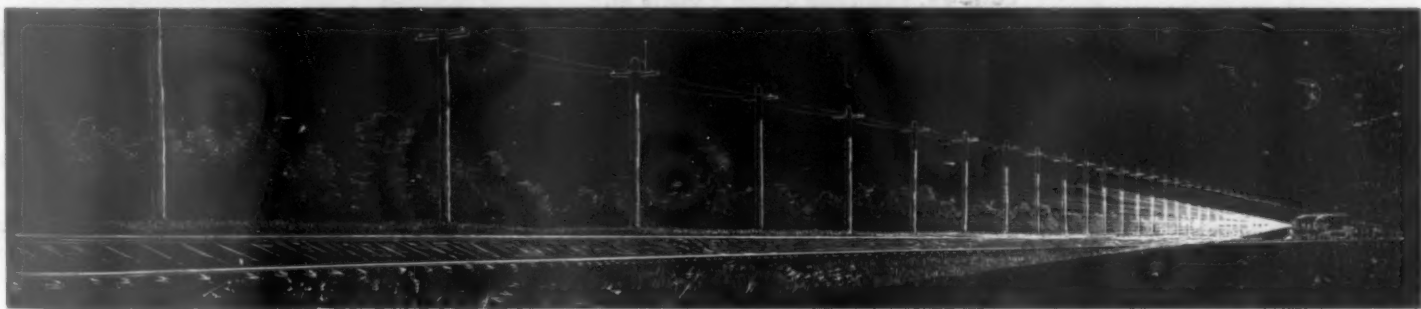
R. B. F. PEIRCE, President and General Manager.

THE NATIONAL ELECTRIC HEADLIGHT COMPANY,

INDIANAPOLIS, IND.

The only powerful headlight for locomotives that has stood the test of extensive use.

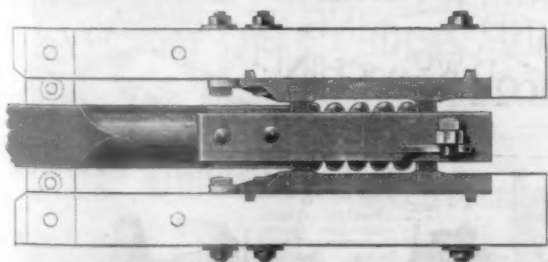
The National Electric Headlight is now in operation on ten roads, among which are: the Vandalia, the Cincinnati, Hamilton & Dayton; the Indianapolis, Decatur & Western; the Queen & Crescent Route, the Monon, and the Chicago & Eastern Illinois. Every engineman who has been behind one of these lights is enthusiastic in its praise.



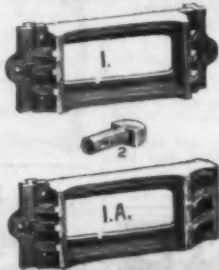
The National Electric Headlight is advantageously used on passenger and freight trains, on double and single track. It renders any obstacle plainly visible at sufficient distance to stop a train, even when running at the highest rate of speed. An object like a horse or a cow can be seen half a mile, and a car or a larger object can be seen one mile or more. An engine rounding a curve lights up the surrounding country to such an extent that there is little possibility of a collision. In other words, it makes daylight for the engineman for sufficient distance ahead to enable him to prevent collisions and derailments.

The National Electric Headlight is an arc light of 2,000 candle power, placed in an ordinary case of the usual style, with the ordinary reflector. It is run by a small dynamo placed immediately behind the light, which is supplied with steam by a pipe from the cab. The engineman from his seat can instantly shut off or turn on the steam, and thus extinguish or relight the lamp, as desired. Three years unvarying success in use. Send for detailed testimony, full description and terms. Trial headlights furnished.

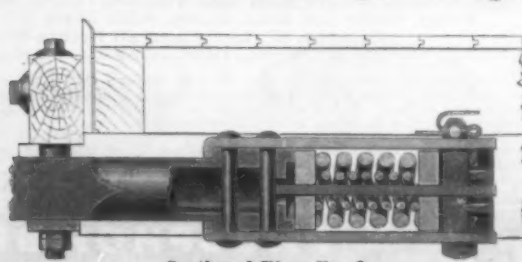
HINSON DRAW-BAR ATTACHMENT, 506 The Rookery, Chicago.



Plan View No. 1.



Perspective.



Sectional View No. 2.

This Attachment is in Satisfactory Use on a Large Number of Cars and Adopted as Standard by a Number of Companies. For repairs on old cars we make a pattern with the holes to correspond with the ones now used in such cars, but for new work we prefer to furnish our standard.

J. A. HINSON, President.

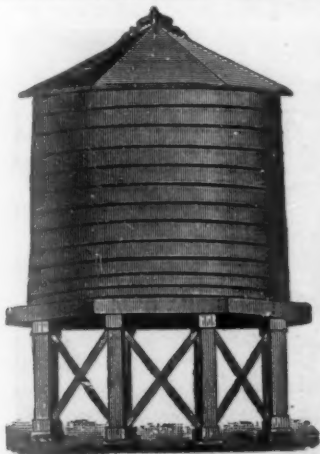
P. M. REAGAN, Secretary.

LINK-BELT

ENGINEERING CO.
NICETOWN
PHILA.
49 DEY ST.
NEW YORK.

Elevators, Conveyors, Manila Rope Power Transmission Machinery, Ewart Detachable Link Belting Dodge Chain, Howe Chain, etc.

Western Connection: **LINK BELT MACHINERY CO., Chicago, Ill.**



ESTABLISHED 1840.
GEO. J. BURKHARDT'S SONS
(Successors to GEO. J. BURKHARDT & CO.)

Factory:
NORTH BROAD, BELOW OAMBRIA ST
Near Germantown Junction Station,
Pennsylvania Railroad.
Down Town Office.
NO. 240 CHESTNUT ST.,
Philadelphia, Pa.

CEDAR TANKS

FOR WATER STATIONS.

From 1,000 to 100,000 Gallons Capacity

A long experience has shown that CEDAR is the best material for Water Tanks, being more than twice as durable as Pine, and can be furnished by us at about the same cost.

THE GUARANTEE CO. OF NORTH AMERICA.

The Oldest and Largest in America.

BONDS OF SURETYSHIP. NO OTHER BUSINESS.
PAID UP CAPITAL, \$300,000. ASSETS, nearly \$750,000. ANNUAL REVENUE, over \$300,000.
HEAD OFFICE, ST. JAMES STREET - MONTREAL.
President, SIR ALEXANDER T. GALT; Vice-Pres. and Managing Director, EDWARD RAWLINGS; JAMES GRANT, Secretary and Attorney. With Branch Offices and Agencies in the principal cities throughout the United States and Canada.

GATES ROCK AND ORE BREAKER.

Number Sold in 1891 Excels All Former Records.

We Beg to Announce the Following Specialties for 1892:

A New Fine Crusher to Supplant Rolls.

A New Dry Ore Concentrator—the Card.

A New Wet Ore Concentrator.

Improved Cornish Rolls. Simple and Effective

Grinding Pans, Stamp Mills, Driers,

All Mining Machinery.

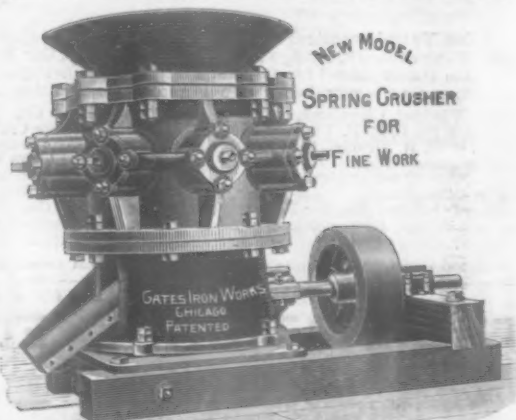
GATES IRON WORKS,

50a S. Clinton St., CHICAGO.

NEW YORK, 136 Liberty St. BOSTON, 237 Franklin St.
LONDON, ENG., 73a Queen Victoria St.



2,500
In Use.



KEUFFEL & ESSER CO., NEW YORK.

Exclus BLUE PRINT PAPER.

Exclus is the cheapest, no waste, no failures.
Exclus makes the best prints.
Exclus keeps longest and gives the most permanent prints.

Exclus is light in weight but very strong.
Exclus is made to stand very much washing.
Exclus when washed and dried is stronger than it was before.

IMITATIONS are plentiful. The principal advantage claimed for the imitations is the low price.

We claim that Exclus is the cheapest, for the reasons stated above.

Exclus Blue Print Paper is the best for prints for mailing, etc.

Columbia Blue Print Cloth, recommended for prints for rough usage.

Triglavine Paper gives black lines on white ground.

Positive fac-similes of drawings from tracings.

Samples, Price Lists and Information cheerfully furnished. Photo Printing for the Trade.

LEHIGH VALLEY R. R. AND AMERICA'S GRANDEST SCENERY.

DOUBLE TRACK. STEEL RAILS.

The Popular Route Between New York, Philadelphia,

Easton, Bethlehem, Allentown, Mauch Chunk, Wilkesbarre, Pittston, Scranton, Ithaca, Geneva, Waverly, Watkins' Glen, Elmira, Rochester, Buffalo, Niagara Falls, Toronto, Detroit, Chicago, St. Louis and all Points West.

Pullman Palace Cars on all Through Trains, Anthracite Coal used exclusively. No dust. No smoke.

TICKET OFFICES: NEW YORK—General Eastern Office, 235 Broadway; Depot foot of Cortlandt Street; Depot foot of Desbrosses Street; all Penna. R. R. Ticket Offices and Dodd's Transfer Co. Offices. PHILADELPHIA—424 and 536 Chestnut Street; P. & R. Depot, Ninth and Green Streets; P. & R. Depot, Third and Berks Streets.

The mountain and valley scenery traversed by this line is the most beautiful and picturesque in America embracing the romantic valleys of the Susquehanna and Lehigh, and the historic Wyoming. Ask for tickets via "Lehigh Valley Route."

K. R. BYINGTON, Gen'l Pass. Agent, Mauch Chunk, Pa.

H. STANLEY GOODWIN, Gen'l Supt., Bethlehem, Pa.

ALL GENUINE
INGOTS & MANUFACTURES
BEAR OUR
REG. TRADE MARKS.



PHOSPHOR-BRONZE
INGOTS, CASTINGS, WIRE, SHEET & C.
THE PHOSPHOR-BRONZE SMELTING CO. LIMITED
512 ARCH ST. PHILADELPHIA PA. U.S.A.
ORIGINAL MANUFACTURERS OF PHOSPHOR-BRONZE IN THE UNITED STATES AND SOLE MAKERS OF "ELEPHANT BRAND" PHOSPHOR-BRONZE.

McGILL THE VERTICAL PLANE MUST GO SETTLES THE QUESTION.

World's Fair

Freight Passenger CAR McGILL IRON WORKS CO. PEORIA, ILL.

Couplers.

See the other ad.

GENERAL RAILROAD PRINTING AND STATIONERY SUPPLIES.

W. H. CAMPBELL 23 UNION SQUARE NEW YORK

DUPLICATE TICKETS SPECIALTY

TWENTY YEARS EXPERIENCE. CAN REFER TO MORE THAN TWO HUNDRED LINES. ORDERS MAY SAFELY BE SENT BY WIRE WHEN NECESSARY AND WILL RECEIVE IMMEDIATE PERSONAL ATTENTION. ALL WORK AND STOCK GUARANTEED FIRST CLASS OR NO CHARGE. SAMPLES AND PRICES FURNISHED OFFICIALS ONLY.

GRAPHITE PAINT.

For Tin or Shingle Roofs and Iron Work.
It is Absolutely Without an Equal. A tin roof well painted will not need repainting for 10 to 15 years. If you need any paint it will pay you to send for circular.
JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J.

Field Engineering.

BY WM. H. SHARPLES

A hand-book of the Theory and Practice of Railway Surveying, Location and Construction.
THE RAILROAD GAZETTE, 75 BROADWAY, N. Y.

WATERPROOF INSULATING PAPERS FOR REFRIGERATOR CARS.

P. & B.

Largely Used and Endorsed by the LARGEST CONSUMERS IN THE WORLD

THE JOHN A. WHITE CO. DOVER N.H.

MANUFACTURERS OF STANDARD WORKING MACHINERY

The Long & Allstatter Co. HAMILTON OHIO.

Double, Single, Angle-Bar, Gang, Horizontal, Twin, Boiler, Spacing, Gate, Multiple, Belt and Steam-Driven Pumps & Shears.

Over 300 Sizes. Send for New Catalogue.

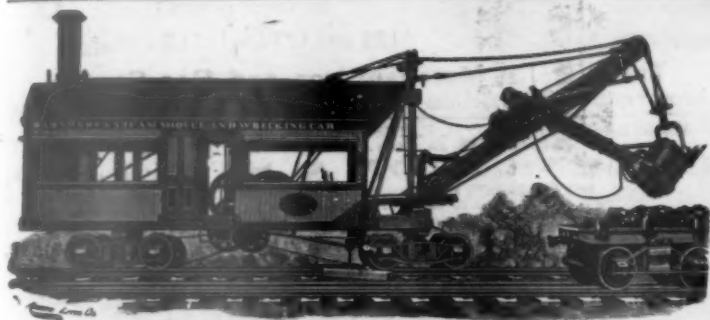
INDUSTRIAL WORKS,
BAY CITY, MICH.

NEW YORK AGENCY
OFFUTT & CO.,
Corner Church and Beccer Streets.

CHICAGO AGENCY
L. M. SLACK,
411 Phenix Building.

CRANES,
WRECKING CARS,
STEAM SHOVELS,
PILE DRIVERS,

RAIL SAWS,
TURN-TABLES,
TRANSFER TABLES,
FREIGHT CONVEYORS.



One and One-half Yard Shovel.

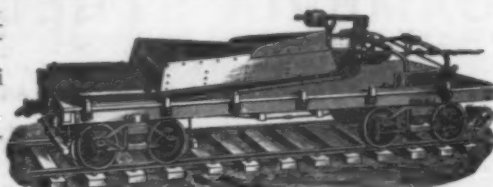
MARION STEAM SHOVEL COMPANY

MANUFACTURERS OF

BARNHARDT'S PATENT STEAM SHOVELS, WRECKING CARS AND DREDGES
RAILROAD DITCHERS AND BALLAST UNLOADERS.

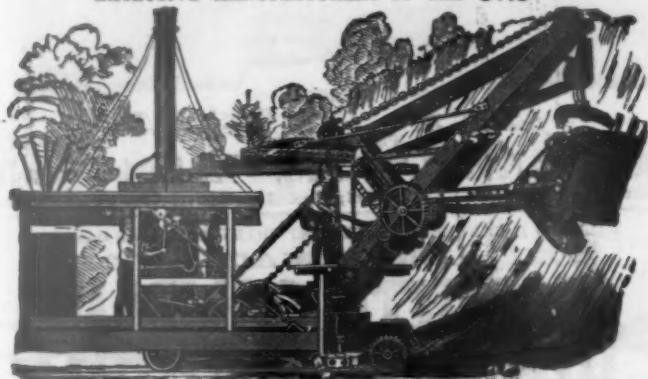
All of our machines guaranteed to give entire satisfaction, otherwise may be returned at our expense.
For further information, photographs, catalogues and discounts address

Marion Steam Shovel Co.,
595 West Centre Street,
MARION, O.
San Francisco Office:
Geo. W. Barnhardt, 4 Sutter St.



Barnhardt's Patent Ballast Unloader.

JOHN SOUTHER & CO., BOSTON, MASS
EXCLUSIVE MANUFACTURERS OF THE OTIS



Patent Steam Excavators,
WITH CHAPMAN'S IMPROVEMENTS AND DREDGES.

DREDGES & SHOVELS

STEAM DREDGES.
STEAM SHOVELS.

—FOR ALL PURPOSES.—

Bucyrus Steam Shovel & Dredge Co.,
BUCYRUS, OHIO.

OSGOOD DREDGE CO., 37 State Street, Albany, N. Y.



No. 1.—Weight, 10 tons. Capacity, 4 cubic yards per minute.

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STEAM EXCAVATORS AND DREDGES. Can aside from our Standards (Nos. 1 and 2); we build machines of special design, or from any drawings furnished.



THE CYCLONE PORTABLE FORGES

Have Double Ratchet, Solid Frame, Adjustable Legs, Detachable Lever. Run Lightest, Make Strongest Blast & Last Longest. ALL DESIRABLE STYLES AND SIZES. Sold by Hardware and Machinery Dealers everywhere. Send for Catalogue of these and Hand & Power Blower, Blacksmith Drill Presses, &c. THE FOOS MFC. CO. SPRINGFIELD, OHIO.

Rock Drilling and Air Compressing

MACHINERY

FOR

TUNNELS, QUARRIES, MINES, RAILROADS,

And Wherever Ore and Rock are to be drilled and blasted.

RAND DRILL CO.,

23 Park Place, - - - NEW YORK.



THE NEW HIGH EXPLOSIVE

RACKAROCK

Furnished in two ingredients which are absolutely unexplosive until combined by the consumers, for which we furnish convenient means. Shipped and stored as ordinary merchandise. After combination the explosive is absolutely safe. By reason of its safety it is especially adapted to water-works construction in crowded streets.

Rendrock Powder Co.

28 PARK PLACE, NEW YORK.



Car Pile Drivers.

SEND FOR CATALOGUE.

VULCAN IRON WORKS,
CHICAGO.



SPECIAL NOTICE.

Two handsome photo-engraved display sheets entitled:

"Recent Improvements in Air Compressors."
"Recent Improvements in Rock Drills."

Mailed free to any one who will cut out this advertisement and mail it to us with his name and address.



The Ingersoll-Sergeant Drill Co.,

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ILLINOIS STEEL COMPANY

Manufacturers of Bessemer, Foundry and Mill Pig Iron, Spiegel and Ferro-Manganese; Iron Rods of any required chemical composition; Iron or Steel Car Truck Channels; Steel "I" Beams and Structural Shapes. Rolls for Standard Sections and Shapes always in stock. Special Sections and Shapes made to order.

BESSEMER STEEL RAILS

FROM 8 TO 100 LBS. PER YARD.

This Company owns and operates five works, namely: NORTH WORKS and UNION WORKS, Chicago; SOUTH WORKS, South Chicago; JOLIET WORKS; MILWAUKEE WORKS.
 JULIAN L. YALE, General Sales Agent, General Offices, "Rookery," Chicago, Ill. Milwaukee (Wis.) Office, 151 N. W. Ins. Building. New York Offices, 46 Wall Street. D. E. GARRISON & CO. Agents, St. Louis, Mo.

THE SPRINGFIELD IRON COMPANY,

SPRINGFIELD,
CHICAGO OFFICE:
710-711 Phenix Building.



ILLINOIS.
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IRON AND STEEL SPLICE BARS.

Track Bolts, Merchant Iron and Bar Steel. The largest capacity and best facilities in the United States for making Angle Splice Bars.

CAMBRIA STEEL RAILS.

HEAVY RAILS, LIGHT RAILS AND RAIL FASTENINGS. STEEL CAR AXLES. STEEL CAR CHANNELS. STREET RAILS.

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Make a Specialty of
SOLID STEEL
RAILROAD TRACK TOOLS.
ALSO SOLE MANUFACTURERS OF
THE PATENT
VERONA NUT LOCK

SEND FOR OUR NEW CATALOGUE.
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THE FARIST STEEL COMPANY

JOEL FARIST, Pres.
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Manufacturers of all descriptions of
CAST STEEL,
HAMMERED OR
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RAILROAD AND MACHINERY FORGING.

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PITTSBURGH, PENNA.
ELLIPTIC & SPIRAL SPRINGS
OF EVERY DESCRIPTION.

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MANUFACTURERS OF

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Cast Steel, Spring Steel, all sizes and grades. Railroad Spring Steel a specialty.

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WORKS:
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Passenger Car Ventilator.

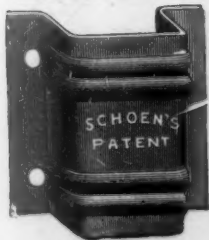
ALL CINDERS, DUST AND DIRT EXCLUDED.

A SUPPLY OF FRESH AIR GIVEN.

PERRY VENTILATOR CO.,

L. F. BRAINE, Gen'l Sales Agent,

Room 30. 1115 Broadway, Boreel Building, New York. JNO. W. CLARKE, Gen'l Western Agent, 470 The Rookery, Chicago, Ill.



SCHOEN MANUFACTURING Co.,

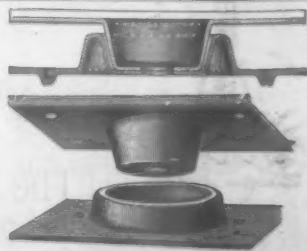
MANUFACTURERS OF

Articles in PRESSED STEEL for Railways

Pressed Steel Stake Pockets | Made to Interchange with any Standard. | Pressed Steel Centre Plates

PITTSBURGH, PA.

Western Office: 314 Phenix Building, Chicago, Ill.



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LUKENS IRON & STEEL CO.

ESTABLISHED 1810. INCORPORATED 1890.

STEEL AND IRON PLATES. Firebox Steel Plates a specialty. We Can Roll Steel Circles 116 in. Diameter, or Rectangular Plates 114 in. Wide. Range of Thickness, from 1/4 to 1 1/4 in.



Ultimate, 55,000. Elongation, 42%. Elastic Limit, 34,000. Reduction of Area, 58%. Phosphorus, 0.03.

COOLBAUGH & POMEROY, GENERAL RAILWAY AGENTS, 29 Broadway, New York. Works: Coatesville, Pa. Philadelphia Office: Rooms 62 & 64 Bullitt Bldg.

WILLARD L. CANDEE and H. DURANT CHEEVER, Business Managers.

THE INTERNATIONAL



LIMITED.

13 Park Row, New York.

INSULATED WIRES AND CABLES

FOR AERIAL, SUBMARINE AND UNDER GROUND USE.

SOLE MANUFACTURERS OF

CANDEE AERIAL WIRES. MANSON PROTECTING-TAPE. OKONITE WATER-PROOF TAPE.

BRANCHES: Chicago, Philadelphia, Boston, San Francisco. Cincinnati, Louisville, Omaha, Minneapolis, St. Louis, Kansas City, London, South America.

O'NEIL'S

Automatic Highway Crossing Alarm

is in use on the New York, Chicago & St. Louis; New York, Lake Erie & Western; New York, Pennsylvania & Ohio; Chicago & Erie; Lake Shore & Michigan Southern; Chicago & Grand Trunk; Flint & Pere Marquette; New York, Susquehanna & Western; Colorado Midland; Toledo, Ann Arbor & North Michigan; Cincinnati, Jackson & Mackinaw; Baltimore & Ohio Southwestern; Pittsburgh & Western; New York & New England; Cincinnati, New Orleans & Texas Pacific, and other railroads.

Suitable for All Locations, Either Double or Single Track.

ELECTRIC SUPPLY & MFG. CO.

113 Public Square, CLEVELAND, O.

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WILLIAM P. HALL, President.

W. S. GILMORE, Treasurer.

MELVILLE P. HALL, Secretary.

S. MARSH YOUNG, General Agent.

C. W. BREWSTER, Sales Agent.

HENRY BEZER, Mechanical Signal Engineer.

A. J. WILSON, Sup't Electrical Construction.

The Hall Signal Co.

PROGRESS:

January 1, 1890, in operation on - - - - - TWO ROADS.

March 1, 1892, in operation and process of erection on TWENTY-FIVE ROADS.

WIRE CIRCUIT AND RAIL CIRCUIT AUTOMATIC ELECTRIC SIGNALS.

We have added to our Automatic Electric Signal Systems

Mechanical and Auto-Manual Block Signaling

IN ALL ITS BRANCHES,

Having obtained control of the BEZER LOCK AND BLOCK SYSTEM, BEZER AND BURLEY INTER-LOCKING MACHINES, besides the best known forms of Semaphores, Compensator, Selector, etc.

Our new Lock and Block System was devised by Mr. Bezer (who originally came to this country as the representative of the Sykes Lock and Block System) from a full knowledge of the shortcomings of other Lock and Block Systems, and in combination with the Hall Track Instrument, for its automatic locking feature, renders this the most perfect Operator System ever devised.

The Bezer and Burley Interlocking Machine possesses most important improvements in actuating mechanism, and is the only machine in which MITRE locking with a HORIZONTAL TAPPET can be satisfactorily and successfully used.

The reputation of this Company for perfection of workmanship, and our guarantee of efficiency will assure satisfaction in the field of mechanical work.

THE HALL SIGNAL COMPANY,

50 BROADWAY,
NEW YORK.

340 THE ROOKERY,
CHICAGO.

Please Note Announcement on Next Page.

A SIGNAL SUCCESS.

OUR SYSTEMS of automatic electric block signals (on wire and rail circuits) are working with great satisfaction to the railroad companies using them, and in almost every case their use is being extended.

Our new rail-circuit systems are showing unparalleled results. Eleven of these signals, on a certain road, have been operating over seven months with a record of but four train stops (caused otherwise than by trains in block and open switches), and these were due to signals being struck by lightning, one broken battery jar and to one broken rail. They have also operated with **ABSOLUTE RELIABILITY**. From the reports of railroad companies using other rail-circuit signals, we are justified in claiming that no such good results (or records) have ever before been shown.

Having substantiated our claims to the complete satisfaction of many leading railroad officials, we are now engaged in applying the systems on several new lines, and we are also engaged in preparing **PLANS AND ESTIMATES FOR THE APPLICATION OF THE SIGNALS FOR MANY OTHER COMPANIES**, several of whom do not consider any other signal than

THE HALL.

We pride ourselves on the excellent and honest character of our work, and beg to assure who deal with us that they will be fairly and squarely treated, and always with the assurance of satisfaction. All correspondence that may be addressed to our New York or Chicago office will receive careful and immediate attention, and any inquiries on any subject relating to our specialties will command the professional knowledge and skill of our engineering department.

THE HALL SIGNAL COMPANY,

50 Broadway, New York.

340 The Rookery, Chicago.

WILLIAM P. HALL, President.
S. MARSH YOUNG, General Agent.
C. W. BREWSTER, Sales Agent.

HENRY BEZER, Mechanical Signal Engineer.

W. S. GILMORE, Treasurer.
MELVILLE P. HALL, Secretary.
A. J. WILSON, Sup't Electrical Construction.

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THE KINSMAN BLOCK SYSTEM COMPANY,

CENTRAL BUILDING,

LIBERTY STREET, NEW YORK.

[Definite Announcements will be made in this space in succeeding issues.]

Steel Surface Cattle Guards

—MANUFACTURED BY THE—

BUSH CATTLE GUARD CO.,
KALAMAZOO, MICH.

All Steel; not a nut, bolt or rivet used. Over 3,000 placed on 43 roads the first year.

The **COMMON SENSE** Steel Cattle Guard, the best and cheapest guard in the market. Patented July 15, 1890.

FOR TESTIMONIALS, PRICES, ETC., ADDRESS

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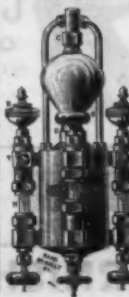
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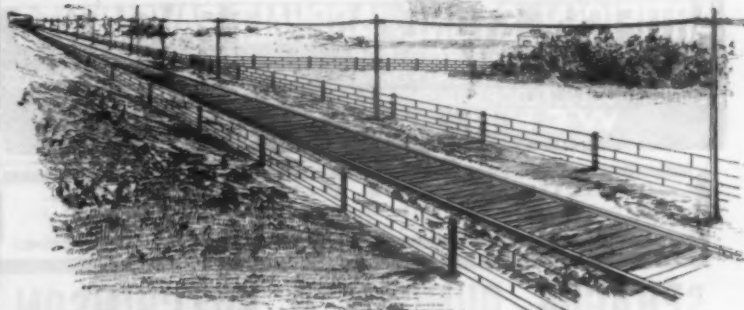
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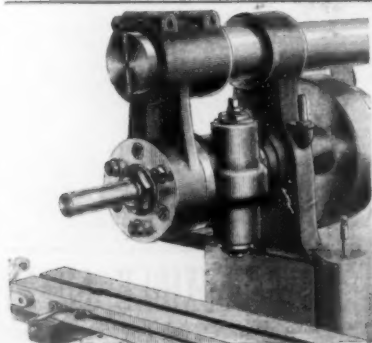
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FRIDAY, APRIL 1.

CONTENTS.

ILLUSTRATIONS:	PAGE.	TRADE CATALOGUES:	PAGE.
Recent French Rails and Joints.....	240	MISCELLANEOUS:	
Butler Draft Gear on the Chesapeake & Ohio Stone Car.....	241	Technical.....	248
Suburban Locomotive with Wootten Firebox.....	242	Railroad Law.....	254
Endurance of Small Rail Heads.....	242	The Scrap Heap.....	248, 253
Map of Railroad from Car-Tagena to the Magdalena River.....	242	The Strength and Material for M. C. B. Couplers.....	241
Madison Car Works—Plan of Property, Building, etc.....	248	American Iron Mining in Cuba.....	249
Time Tests of Natural Cement Mortars.....	244	Train Accidents in the United States in February 245	
The Cyclone Ventilator.....	248	Air Brake Standards.....	246
CONTRIBUTIONS:		Smoke Prevention in St. Louis.....	246
Extension Fronts and Compound Locomotives.....	239	Improvements on English Railroads.....	248
The Section of Driving Wheel Spokes.....	239	Annual Report of the Pennsylvania Relief Department.....	248
The Hudson River and Rapid Transit.....	239	Evolution per Mile and Centrifugal Force of Locomotive and Car Wheels.....	245
NOTES:		GENERAL NEWS:	
Coupler Legislation.....	250	Locomotive Building.....	250
Standard Tests for Air Brakes.....	250	Car Building.....	250
The Extension of the New York, New Haven & Hartford.....	251	Bridge Building.....	253
February Accidents.....	252	Meetings and Announcements.....	254
Notes.....	252	Personal.....	255
NEW PUBLICATIONS.....	253	Elections and Appointments.....	255
		Railroad Construction.....	256
		General Railroad News.....	258
		Trades.....	258

Contributions.

Extension Fronts and Compound Locomotives.

Baldwin Locomotive Works,
PHILADELPHIA, March 22, 1892.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have read the remarks of our friends regarding the extension smokebox on engine No. 385 of the Central Railroad of New Jersey, a Vaucain compound locomotive, designed and built at the Baldwin Locomotive Works, Philadelphia. I send you two photographs of the highest types of fast passenger engine in use in the world, both Vaucain compound locomotives, both designed and built at the Baldwin Locomotive Works, both running over the same railroad, the "Bound Brook Route" between Philadelphia and New York City, and both giving equal satisfaction to their owners, the evidence being that the Baldwin Locomotive Works have received orders for four more engines of each kind without a single alternation, even in the minutest detail.

But, alas, one of the engines has an extension smokebox, the other has none. It may be said by some that the Wootten firebox does away with the necessity for the extension smokebox, but the Baldwin Locomotive Works has made Wootten boilers with and without extension smokeboxes to suit the fuel and service of various railroads. The large grate area of the Wootten engine is of itself conducive to economical consumption of anthracite coal, and the narrow firebox of engine No. 385 is made more serviceable by the use of the extension smokebox as applied. An ordinary force pump works better with an air chamber attached. The flow is more continuous, and the seating of the valves more noiseless than would be the case were it not used. The extension smokebox takes the place of the air chamber on the pump. It reduces the vacuum produced at the time the exhaust steam enters the stack, but allows it to carry out with it as large a volume of gaseous matter at a much lower resistance, as it would were the extension smokebox left off.

It must be borne in mind that all we require on a locomotive engine, compound or plain, is a sufficient volume of air drawn through the grates to properly consume the coal, and the lower the vacuum in the smokebox at which this is done the less fuel will be consumed, sparks thrown and noise made, three very desirable things and all to be had in one locomotive, viz.: a Vaucain compound, as built by the Baldwin Locomotive Works.

S. M. VAUCLAIN,

Superintendent Baldwin Locomotive Works.

[The photographs we do not reproduce. They show No. 385, Central of New Jersey, which was recently illustrated in the *Railroad Gazette* (Feb. 12, 1892,) and No. 618, Philadelphia & Reading. The latter was illustrated and briefly described in our issue of Nov. 13, 1891. It is a Wootten with Vaucain compounding and without extension smokebox.—EDITOR RAILROAD GAZETTE.]

The Section of Driving Wheel Spokes.

SOUTH BOSTON, March 19, 1892.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In the *Gazette* of March 4, I note Mr. Hibbard's reply to my query why the spokes of locomotive driving and truck wheels should be oval in cross-section. As a theoretical argument it is, perhaps, as good as can be made, but it has less force than I had expected to meet.

Questioning his reasons in their order, it may be said that the spokes of such wheels are not, in any proper sense "a large mass;" while the surface of the metal dif-

fers from the interior, the difference is not great. His cross-section, *a*, need not be considered, since few wheels have been made of such form, and it is not probable many will be made. His cross-section, *b*, shows "sharp corners" truly, presumably to give his argument greater force. But a competent designer would not fail to use a quarter-round, of a reasonable radius at this point.

His reference to the connecting rod of a steam engine seems hardly pertinent to the subject. Prof. Smith's statements, quoted by Mr. Hibbard, are correct in principle, but it is not probable Prof. Smith had in mind the designing of wheels for locomotives. But one point in the quoted statements will be considered—that of the "simpler form," meaning the oval. If Mr. Hibbard will have made two wheel patterns, one having oval spokes, and one having spokes of rectangular section, I think he will find, conditions being equal, that the oval form will cost the greater sum.

His theory as to the "threads of crystallization" is substantially correct. It would apply with greater force if I had proposed a design having the "sharp corners," as shown in Mr. Hibbard's reply. His statement that "the continuity of fiber is broken at the corner" is a little singular. The existence of fiber in cast metal will be questioned.

The last paragraph relates to strains upon the spokes (of driving wheels) transmitted through the crank pin. Such strains are undoubtedly great, but are applied uniformly to all the spokes, which is not the case in side strains from the rails. It would be a rare case, indeed, where not enough metal was provided to resist strains applied uniformly to all the spokes of the wheel.

General theories sometimes require modification when applied to specific purposes. At the present day, cast metal girders or beams are rarely used. But if Mr. Hibbard's reasoning, as applied to spokes of locomotive wheels is correct, such girders, if used, should be oval in cross section, since his reasoning applies with greater force to a heavy girder than to the light section of a wheel spoke. It is not probable the oval form will be used in the case of a girder. Can it be controverted that if a spoke breaks there has existed upon one side of the spoke a tensile strain, greatest upon the surface molecules of the metal, and upon the opposite side a strain of compression? If this be admitted, are his reasons sufficient for not providing a large surface and consequently more molecules to resist these strains, rather than the narrow surface—theoretically but a line—of the oval section?

W. G. RICHARDS.

The Harlem River and Rapid Transit.

NEW YORK, March 30, 1892.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The discussion over the proposed law to enable the New York Central & Hudson River Railroad to elevate the approaches to its bridge over the Harlem River has brought out a number of somewhat curious suggestions on the part of that class of the community who have, as they consider, excellent ideas regarding public improvements, which, however, they have difficulty in persuading capitalists to carry out.

One gentleman who has been prominent as an "entrepreneur," as they say in France, or, as we might translate, it an "undertaker," has set forth a proposition that the Harlem River from Third avenue to Jerome avenue or thereabouts should be filled in entirely so that there could be freedom of access to the Manhattan Island by the residents of the Annexed District. This may become a desirable improvement 50 years hence, but in the meantime it would be an injury and a drawback to the growth and improvement of that part of the city on both sides of the stream, and even in the future it is questionable whether the existence of a navigable stream of tidal water from the Hudson to Long Island Sound would not be a most attractive and desirable feature. After the necessity for the lining of the banks of the stream with industrial establishments shall have ceased in consequence of the building up and occupation of the territory for a mile or two on each side of it, the Harlem might be made a rival of the Seine in its passage through Paris, spanned by handsome bridges and bordered by pleasure grounds and elegant buildings.

Another extraordinary scheme which has been developed by the property owners along the few hundred feet of Fourth avenue, on which it is proposed by the railroad's plans to close direct communication from one side of the avenue to the other, is the proposition to elevate the tracks of the railroad from a point one mile south of the river, and carry over the grade of the avenue an elevated metal viaduct on which all of the trains would pass at high speed on a level with the second or third story windows of the dwellings on either side. "A more monstrous piece of folly," to quote again from Mr. Dewey, can hardly be imagined, particularly when to this proposition is attached the proviso that the city of New York shall be taxed for one-half of the construction of of this hideous and peace destroying structure. A bill making provision for this structure has actually passed the Senate, with a limitation of the expenditure on the part of the city, to \$750,000.

The original design of the railroad company seems, from every point of view, far preferable to such an abomination as this would be.

Another suggestion with reference to the solution of

See our issue of March 11 for a letter introducing this subject.—EDITOR.

the rapid transit problem has been made to the effect that the New York Central Railroad might abandon the use of the Grand Central Depot at Forty-second street by all its local trains, meaning thereby such as run only to points about 20 miles distant from the depot, and confine the use of the depot itself and the adjacent yards to its through trains, including those of the Harlem R. R. and the New Haven R. R. For the accommodation of the through traffic and communication with the storage yards lying north of the Harlem River, two of the tracks on Fourth avenue would be sufficient, and two tracks, preferably the two most easterly, might be diverted to the eastward above Forty-ninth street, and run along the easterly line of the railroad property on an ascending grade, so as to cross Forty-second street overhead, and be continued on a viaduct between Lexington and Fourth avenues to Fourteenth street, and thence cross Broadway and continue on a viaduct on the west side of Broadway to the Battery.

The advocates of this scheme do not propose any immutable plan of structure, but suggest that the mode of construction should be such as would be best adapted to the circumstances in any special locality through which the road passes, depending largely upon the value of the real estate which would have to be acquired, the general idea being, however, that the width of right of way to be purchased need not exceed 20 feet except at stations, and that the structure should be adapted to carry from two to four single tracks, one above the other, each having a solid flooring supported on side walls of masonry, the walls being perforated with arched openings to furnish free movement of air, diminish reverberation, and afford security to trackmen and inspectors. Wherever the cost of the right of way might be so great as to demand that a minimum of land should be occupied, it would be perfectly practicable to construct a metal viaduct carrying four tracks, one above the other, of a width not exceeding 16 feet. Except at street crossings there would be no wind strains to be provided for, and lateral stiffness could be sufficiently obtained by increasing the distance vertically between the tracks, thus affording more room for lateral bracing. In case that for a mile or two of the route property could be purchased at a reasonable rate, it might be feasible to have two tracks, or four if necessary, on a level at an elevation of 40 to 50 feet above the street, and carried on bridges of 130 feet span, two piers being placed in each block, and the space beneath the road occupied by business houses, or even dwellings, for the discomfort caused by trains passing overhead would not be greater than that created by the passing of trains in front of the windows of the many thousand dwellings along the line of the present elevated roads.

It would probably be best to construct such a road so as to carry two tracks at present, with provision for the addition of two more tracks in case it should be found desirable in the future. It is likely, however, that for the next 15 or 20 years two tracks would be sufficient for the operation of the road, which would be most advantageously conducted on the plan of making it what might be called a middle distance rapid transit road, that is to say, having stations not less than a mile apart, and running trains at an average speed of 20 miles an hour. With a structure capable of carrying 50-ton engines at this rate, trains seating 300 passengers could be run from Mott Haven to the Battery on three minutes headway. Suburban trains from Croton, White Plains and Mount Vernon could be run to the Battery without transfer of passengers, and without interfering with the regular city traffic. They would simply fall into their proper interval at Mott Haven, and become a part of the regular system, in the same way that South Ferry, City Hall and Grand street trains fall into line on the east side Manhattan system, or the Sixth avenue, Fifty-eighth street and Ninth avenue trains fall in on the west side Manhattan system. On the return trip they could either be laid up at Mott Haven or run through to their suburban terminus.

It appears as if a system such as this could be carried out by the New York Central Railroad without incurring any enormous non remunerative expenditure, in such a way as to relieve the present gorged terminal at Forty-second street, which is the source of the annoying delays in the tunnel ninety-nine times to once that even the present low bridge produces derangement of the trains. The local traffic on such a road from Mott Haven to the Battery would unquestionably be very great, and the advocates of this plan believe that it would be sufficient in itself to pay at least as good dividends on its cost as the New York Central pays on its stock. Some years hence it will probably be necessary and perfectly practicable to increase the carrying capacity of such a road by carrying out the plan which has been suggested of opening up the tunnel from Sixtieth street to One Hundredth street, and putting two or possibly four additional tracks over the present tracks, and also carrying up the structure below so as to carry two more tracks, but for the present two tracks arranged as suggested would be ample for all needs.

Whether this plan is feasible or not, one thing is certain—the citizens of New York and the adjacent parts of Westchester County are suffering from the inadequacy of the existing arrangements for rapid transit. These arrangements are controlled by two great corporations, which could under proper direction add largely to the facilities for speedy communication between the Battery and 25 miles to the north of it at very much less expense

and in very much less time than any new corporation could furnish any facilities at all. Such being the case, it is the manifest duty of the Rapid Transit Commission to devise some practicable scheme which the existing corporations could take hold of and carry out, instead of wasting their time on enormous impracticable projects which it would be difficult to find any capitalists to take hold of, and which would require a great many years to carry to such a state of forwardness as to be of any use to anybody.

BEN TROVATO.

French Rail Joints.

The subject of rail joints is treated quite exhaustively in a paper by Mr. Mussv, Chief Engineer of Mines, in the *Annales des Ponts et Chaussées* for October, 1891. After discussing the historical and theoretical sides of the question, he takes up the different features of the rail joints now in use on French lines.

He speaks first of the fishing angle—the angle with the horizontal of the surface of contact of fishplate and rail.

This angle is practically the same on the six great French systems. On the Paris, Lyons & Mediterranean, Northern, Eastern, Western and Orleans roads, it is 20

steel angles 2.21 ft. long for the "P L M A" rail (see below), this weight is 17,636 lbs. (8,000 kilos). The material must endure this test without showing a sensible set after the pressure is taken off. The second tests are a continuation of the first, and are made by subjecting the joint to a load for five minutes, under which it must not break. For the two angle bars above noted, these loads are 38,580 lbs. (17,500 kilos.) and 36,380 lbs. (16,500 kilos.) respectively. The third tests are made by increasing the distance between supports to 3.61 ft., and subjecting the joint to a drop test, by letting a weight of 440 lbs. (200 kilos.) fall from a height varying with the joint under examination. For the two already considered these are 6.23 and 5.9 ft. respectively. Unfortunately the author does not state explicitly whether the rails in the second and third tests are rested head down or not, but the inference is that this is the case.

Other tests, considered less important in France, are also required, such as those to determine the tensile strength of the metal, which must be at least 71,116 lbs. per sq. in. (50 kilos per sq. mm.) with an elongation between 15 and 25 per cent. The entire set of tests is similar as regards methods to those of material for rails. The metal for joints, however, is a little softer.

Until recently the bolts for joints were always made

are interesting, from a historical point of view, and are outlined in the following table:

Sec. ton.	Material.	Length, ft.	Area, sq. ins.	Weight, lbs. per pair.	Form.
1860 I.	Iron	1-3 7/8	2.4	21	fish plate.
1867 I.	Iron	1-7	2.4	25	fish plate.
1875 II.	Steel	1-7	2.7	27 1/2	plate and angle.
1880 I.	Steel	1-7	2.9	3 1/4	fish plate.
1880 II.	Steel	1-7	3.55	33 1/4	plate and angle.
1889 I.	"P M" Steel	2-3 6	4.11	61	angle bar.
1889 II.	"P L M A" Steel	2-2 5	3.71	57 1/4	angle bar.

A few words are necessary to explain some apparent discrepancies in the above table. The joint 1867 II., was formed by a fish plate of the type 1867 I., on the outside of the rail, and an angle bar of 3.4 sq. in. area on the inside. The joint 1875 is marked iron on the cut accompanying the paper, but was of steel, as the text is plain on this point. The type 1880 I., had a slight base, so that in section it was half way between a fish plate and an angle bar. The joint 1880 II., had an exterior steel bar of the preceding type and an interior iron angle bar of 3.55 sq. in. sectional area.

Up to 1889, whenever rails were replaced it was always found that the ends were much worn away, whether the plates were used or not. Hence it was decided in that year to use a much heavier joint, consisting of two similar angle bars, shown in fig. 1. The Vignole rail weighing 94.8 lbs. and steel tie plates were used, as indicated in the cut. To prevent creeping screw bolts pass through the base of the angles and the tie plates into the ties. The section 1889 II. is similar to this except in its weight, while on very important sections the length of the joint has been increased to 2 ft. 6 1/4 in., the weight of the pair of angles to 81 1/4 lbs. and the area of each angle to 4.50 sq. in.

The Northern Railroad has adopted the joints shown in fig. 2 for its 60-lb. rail. It consists of two like fish plates of iron, 1 ft. 5.8 in. long, 0.69 in. thick and 2.95 in. high. Four 3/4-in. bolts are used, passing through 0.79-in. holes in the plates and 0.94-in. holes in the rail. This is for supported joints, where the suspended type is used the length of the plates is increased to 1 ft. 8.4 in. and the holes are of an oval section. In the latter joint moreover, the exterior plate has a groove in which the head of the bolt is caught and prevented from turning. The steel rail 4.94 in. high, with a web 0.47 in. thick, a head of 2.2 in. and a base of 3.82 in. The pair of plates weigh 22 lbs.

For use with its 86.7-lb. steel rail the same company has adopted the angle bar, shown in fig. 3. These are either steel or iron and are alike save that the exterior angle has slight projections to prevent the bolt from turning. The thickness of the angle is 0.94 in., and it is 2 ft. 1.6 in. long. Four 0.98-in. iron bolts are used; they pass through 1.08 in. holes in the angles and 1.22-in. holes in the rail. The latter has a height of 5.59 in., with a web 0.59 in. thick, a head of 2.36 in. and a base of 5.32 in. The pair of angles weigh 56 lbs. The tests for the metal for these joints differ materially from those in force on the P. L. & M. line. Test bars 7.87 in. long must show an average ultimate strength of 49,780 lbs. with an elongation of 18 per cent., while the lowest bar must have a strength of not less than 45,514 lbs. and an elongation of not less than 15 per cent. Bending and other tests are also prescribed.

The Eastern Railroad, like the Northern, has always used the Vignole rail, but is very conservative and makes few changes. Its first rail was a 70.6-lb. iron section, which was slowly replaced by a 60-lb. steel rail. In fact it was not until quite recently, according to Mr. Massey, that this company ceased ordering iron rails. The parts of the system under heaviest traffic are now laid with an 88.7-lb. steel rail 5.55 in. high having a base of 5.2 in. The iron rail had a joint composed of 2 similar fish plates 1 ft. 5.7 in. long, 0.79 in. thick and 2.52 in. high, weighing 18 lbs. a pair. These were held by four 0.79 in. bolts passing through 0.67 in. holes in the plates and 0.94 in. holes in the rails. The joint of the 60-lb. rail was peculiar in some respects. Inside the rail was a steel plate 1 ft. 8 in. long, while outside was a steel angle 2 ft. 5.5 in. long, the pair weighing 39 lbs. Four 0.9 in. bolts were used, passing through 0.98-in. holes in the plate and bar and 1.06 in. holes in the rail. With the 88.7-lb. rail, the steel angle bars shown in fig. 4 have been designed. These are alike in form and are 2 ft. 6.7 ins. long. They are attached to the ties at each end by two screw bolts. The thickness of the metal has been raised to 0.94 in. and the weight per pair to 79 lbs. They are secured by four 1.06 in. bolts passing through 1.14 in. holes in the angles and 1.26-in. holes in the rail. The metal for the bars is tested as for the Northern company. A bar 7.87 in. long must have an ultimate strength of 59,737 lbs. and an elongation of twenty per cent. The tests for the nuts are rather unusual but need not be described here.

The Orleans Railroad made a number of experiments some years since on the best form of rail to secure easy riding at high speeds, which resulted in the adoption of an 84.7-lb. English bullhead section. The old rail was of the doublehead type and was very unsatisfactory. The new type and its joint are shown in section in fig. 5. The angle of the head is 25 deg. 34 min. instead of 49 deg. 45 min. as formerly, and corresponds with the inclination of 1 in 2 in general use in France. The joint is 1 ft. 5.7 in. long, and the two sides curve down under the rail until 0.8 in. apart. The outer bar is grooved to hold the head of the bolt when the nut is being tightened. The metal

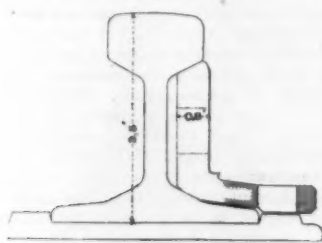


Fig. 1.

P. L. & M., 94.8 lbs.

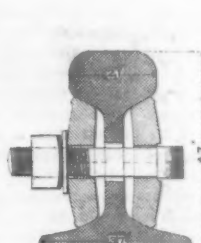


Fig. 2.

Northern, 60 lbs.

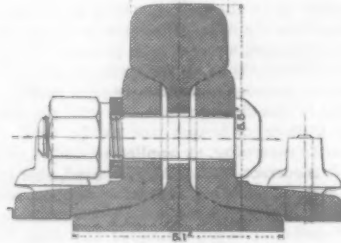


Fig. 4.

Eastern, 88.7 lbs.

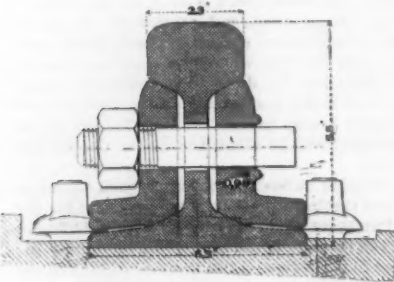


Fig. 3.

Northern, 86.7 lbs.

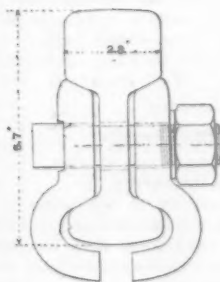


Fig. 5.

Orleans, 84.7 lbs.

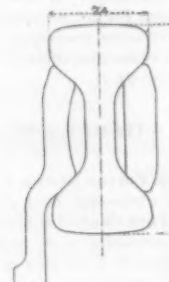


Fig. 6.

Western, 78 lbs.

RECENT FRENCH RAILS AND JOINTS.

deg. 34 min., corresponding to an inclination of 1 in 2, while on the Southern this angle is 28 deg. 30 min., corresponding to an inclination of 6 in 11. This is nearly double the angle recommended in the last report of the Committee on Standard Rail Sections of the American Society of Civil Engineers, which was 13 deg. In Germany the angle is nearly the same as in the United States, while with the 106.3-lb. Sandberg (Goliath) rail in Belgium an inclination of 1 in 5, equivalent to 11 deg., has been adopted. The inclination of 1 in 2 has long been used on the Northern, Eastern and Lyons roads and on the sections of the Western road laid with Vignole rails; on the roads using double-headed sections it was recently adopted with the heavy rail of the English bullhead type.

The length of the bars was formerly restricted to from 1.31 to 1.57 ft., and it is only in recent times that the Lyons railroad initiated the movement for a greater length by adopting a bar 2.29 ft. long, while for its heavy 94.8 lb. rail a length of 2.62 ft. has been selected. The other companies have made similar changes, and the number of bolts has been increased from 4 to 6 to correspond. Corresponding with this increase in the length of the bars has been an increase in the width of contact with the head of the rail, which at first was considerably less than 0.5 in., and on some of the heavy track of the Lyons road now amounts to 0.8 in., due chiefly to a wider rail head.

The material of which the joints are made is now subject to as definite tests as that for rails. On the Lyons road three sets of tests are made, which determine the minimum tensile strength and the maximum hardness. The first test is made by joining two rail ends, each 4.9 ft. long, by bars and bolts in the same manner as in actual practice. This combination is then rested on two supports 3.28 ft. apart, head down, and subjected for five minutes to a pressure at the centre of the piece. This pressure is applied to the base of the rail and varies according to the type of the joint. For the 2.29-ft. steel angle bar used with the "P M" rail, to be described below, it is 19,845 lbs. (9,000 kilos.), while for

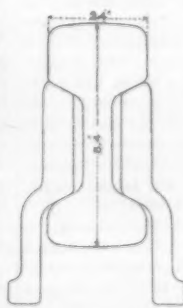


Fig. 7.

Western, 88.7 lbs.

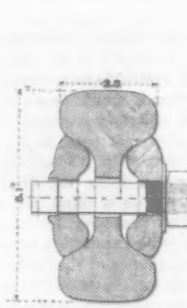
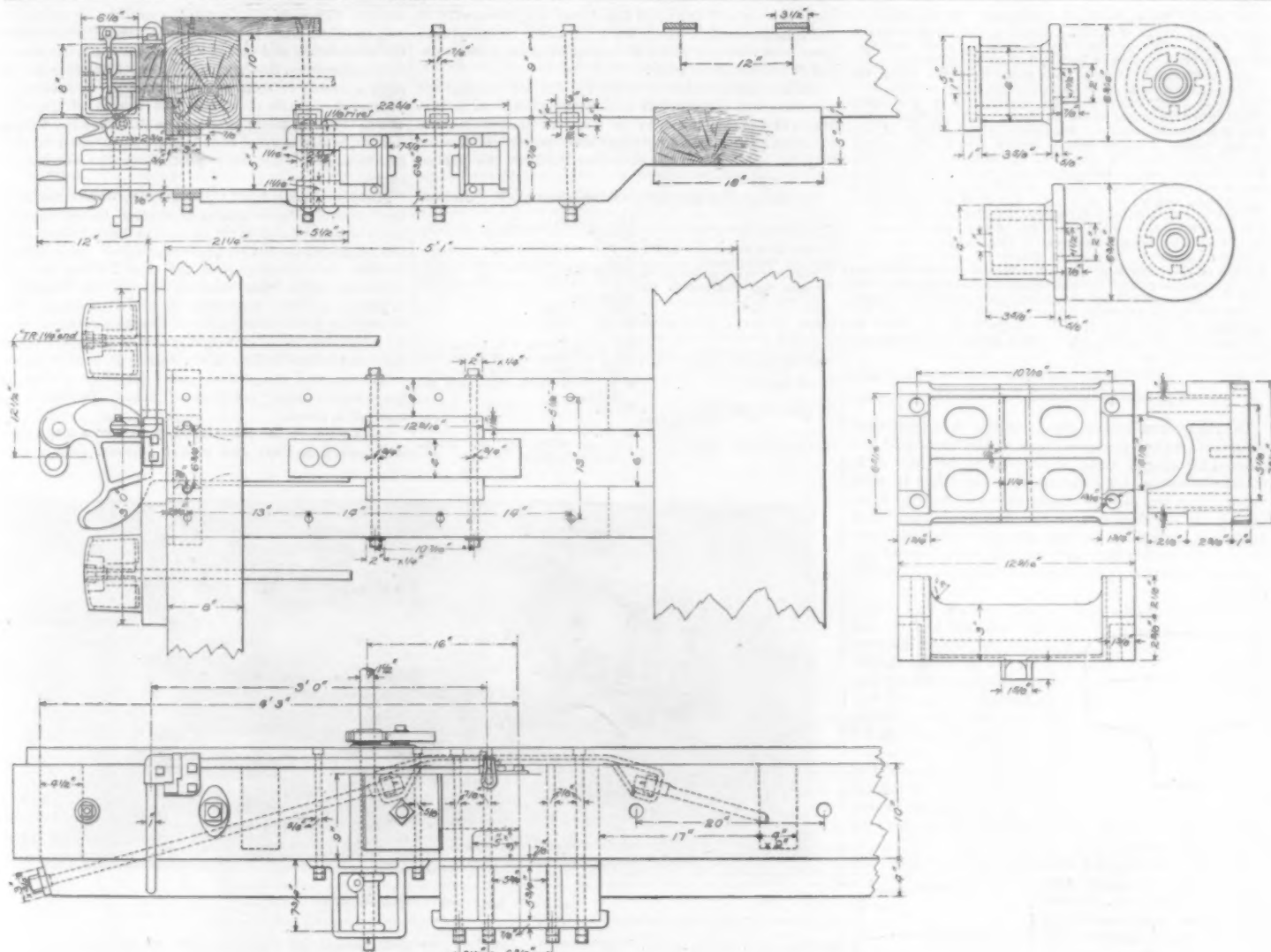


Fig. 8.

Southern, 74.6 lbs.

of a very superior grade of fine grained iron. The Paris, Lyons and Mediterranean company has adopted soft steel for angle bars, screw spikes and bolts, but still clings to iron nuts. The diameter of the shank of the bolt is 0.98 in. (25 mm.); the head is semi-circular for half its perimeter and for the remainder is bounded by straight lines, so that the part that presses against the base of the angle bar prevents the whole bolt from turning. The bolt weighs 1.65 lbs. The metal from which they are made must have an elastic limit of 31,291 lbs. and a breaking strength of 64,000 lbs. The test bars have a "useful length" of 3.93 in. and a diameter of 0.35 in., the elongation being from 18 to 22 per cent. The nuts are subject to a number of tests which need not be described here.

Passing from these general details, which are treated in a much more extended manner in the paper of Mr. Mussv, to the types of joints actually used by the French railroads, the sections adopted on the lines of the Paris, Lyons & Mediterranean Railroad are first in order. The changes that have taken place in joints of this road



THE BUTLER DRAFT GEAR ON THE CHESAPEAKE & OHIO STONE CARS.

in the body of the bar is 0.87 in. thick, in the lower part 0.71 in. The bars are iron and are connected by four bolts 0.98 in. in diameter passing through 1.18 in. holes. These bars weigh 42 lbs. per pair, and are made from metal tested in the same manner as that for the P. L. & M. company, save that test bars rather than actual rails are apparently employed and the requirements are slightly different.

On the Western Railroad a double-head rail is used on all the principal lines, a 60.5-lb. Vignole section being employed on the branches. Two sections are in use on this road under heavy traffic. The older weighs 78.1 lbs. and is shown in fig. 6, while the new type weighs 88.7 lbs. and is shown in fig. 7. The joints for both are steel. For the 78-lb. rail the outer bar is 1 ft. 5.7 in. long and the inner 1 ft. 6 in., the two weighing 27 lbs. The bars for the 88.7-lb. rail have similar lengths, but weigh 37 lbs. per pair. The bolts used are 0.98 in. in diameter. The joint used with the Vignole rail much resembles in section that used with the 60-lb. rail of the Eastern Railroad. The metal for these is tested in a similar manner to that for the preceding company.

The Southern Railroad (Midi) was one of the first to adopt 33-ft. rails and use steel in place of iron. In fig. 8 are given the details of the joint used on the 74.6-lb rail of this company. The exterior bar is 1 ft. 5.7 in. long and is grooved to hold the head of the bolt, which is 0.79 in. in diameter. The inner bar is 1 ft. 9.3 in. long and has a slightly different section. The pair of bars, which are of steel, weigh 20 lbs., and are tested in somewhat the same manner as for the two roads last mentioned.

The Butler Draft Gear on Chesapeake & Ohio Stone Cars.

As we noticed some time ago, the Butler draft rigging has been giving excellent success on the Chesapeake & Ohio Railroad. The rigging has been redesigned within the last two years and is now in the best form in which it has yet been used. The illustrations show how this gear is used on the Chesapeake & Ohio and give the dimensions of the parts. It is arranged for use with a strap instead of a tail bolt. The details of construction are too clearly shown to require further description, more particularly as we have previously described this gear in considerable detail.

It will be noticed in the illustrations that the Janney coupler is used with dead blocks. This is interesting in that there is now a reviving interest in dead blocks and their usefulness with the M. C. B. standard coupler. In this case the dead blocks are placed 25 in. apart cen-

tres, and of a length which brings the face of the blocks 1½ in. inside the face of the inside knuckle when the drawbar is in a normal position. Hence when two cars are coupled together and the couplers are in a normal condition the dead blocks will be about 3¼ in. apart, and when the dead blocks come together the flange of the drawhead is ½ in. from the buffer plate on the end sill. It is, of course, true in the case of dead blocks when used with the vertical plane coupler, that when the couplers come together with the knuckles closed the dead blocks offer no resistance to reduce the blows on the coupler. In this case, when the knuckles are closed and the drawbars are brought together, the dead blocks are about 5¼ in. apart after the drawbar flange is against the end sill. Some remarks as to the value of dead blocks and spring buffers in a paper by William Forsyth, before the Western Railway Club, were given in the *Railroad Gazette*, March 4 and 11.

The Strength and Material for Car Couplers of the Master Car Builders' Type.

The regular monthly meeting of the Western Railway Club was held in its rooms, 850 to 854 Rookery Building, Chicago, Tuesday, March 15, President Peck in the chair. Discussion of the paper read by Mr. Forsyth at the last meeting on the "Strength of Couplers of the Master Car Builders' Type" was taken up.

Mr. TOWNSEND: We have about 700 or 800 cars equipped and I have instructed all my inspectors to report at once every broken knuckle or drawbar. So far we have had only two drawbars broken. How many have been broken while off on other lines, I am not able to tell. All are malleable iron. Some time ago we tested link and pin drawheads under the hammer, with the result that one blow broke the iron head, the cast steel head broke with three blows, and the malleable iron received thirty-three blows before it gave way.

Mr. BARR: To tell the truth, I don't know anything about the relative value of the two metals for M. C. B. couplers. If we put steel to a shop test, we, of course, get very much better results than can be obtained from malleable iron. The same may be said of steel axles or steel staybolts, but I think anyone in the room here that has had two or three years' experience with steel staybolts would say that they would prefer not to be guided by the preliminary test of the material. There is a difference of opinion as to the relative merits of steel and iron axles, but I am inclined to think that I have got the data that warrants me in favoring the iron axle. Now, when we turn to the drawbars, we find the tests show very decidedly in favor of steel. But the question in my mind is, are those tests comprehensive enough? Do they duplicate the different strains and shocks that a drawbar is exposed to in actual service in such a way as to enable us to prophesy as to what it will do on the road? Is the data we get from mere tests of the strength sufficient to warrant us in saying "This is the material of which to make a drawbar?" I am inclined to question it.

Mr. MUNTON (Chicago Tire & Spring Co.): Mr. Forsyth asks for practically a boiler plate test on a steel casting and gives some government statistics to support his position. Those castings probably cost the government about 15 or 20 cents a pound. Of course we can get no such price for castings for a drawbar. The tensile strength of 70,000 lbs. per sq. in. can be obtained easily enough, but the elongation of 15 or 20 per cent. is excessive. From eight to twelve can be made satisfactorily in a steel drawbar. The drop test suggested can be met easily, as can also the ultimate strength of the bar, 125,000 to 150,000 lbs. As for the comparison between steel and malleable iron, I should think it would be clear to anyone that a material having a tensile strength of 70,000 lbs., and 12 per cent. elongation, was a great deal superior to one that would stand only 30,000 lbs. and with 1 per cent. elongation.

Mr. BARR: A year or two ago the great majority of our breakages were broken knuckles or the lugs of the head broken off. It was only rarely that we saw the guard arm broken. In going over a lot of Master Car Builders' couplers of various makes, a few days ago, I found about 90 per cent. of the broken drawbars with the guard arm either broken entirely off or the upper or lower corner broken off.

Mr. HERR: The breakages in guard arms have been greatly increased in the last two or three years. This is a weakness in a part of the coupler that, it seems to me, will be on the increase as we get more and more Master Car Builders' couplers in service, as the guard arm, in my opinion, is more likely to be broken by a Master Car Builders' coupler than with a link-and-pin coupler.

President PECK: Mr. Forsyth, in your observations, did you find them broken in that manner?

Mr. FORSYTH: The paper states in the beginning that 37 per cent. were broken in the arms.

Mr. QUEREAU: In the last two years the percentage of breakages in the guard arm have almost doubled. The guard arms broken are mostly malleable iron, and steel heads break most frequently in the lugs.

Mr. MARSHALL: Of course the various designs differ somewhat in detail, but in most of them the guard arm is composed of a vertical flange, on the outside of which ribs are cast. This vertical flange is united to the upper and lower horizontal walls which form the head of the coupler. Now the guard arm may be strengthened by ribs to almost any extent desired, but after a certain strength is obtained it will do no good to add more ribs, for the guard arm then becomes stronger than the horizontal walls of the coupler head, and the fracture will then start at the point indicated by Mr. Barr, and, extending through the head and in front of the vertical wall of the guard arm, will end in the side of the stem nearest the guard arm, the latter breaking off entire. I think in malleable iron it is almost impossible to get much more strength at this point, because the upper and lower horizontal walls of the head are already as thick as is advisable where this metal is employed, and it seems that a metal with great tensile strength like steel is the only way to remedy it.

Mr. F. W. SARGENT: I would like to ask if any one has any figures as to the ratio between broken drawbars and broken tail bolts. The tendency now is to make the drawbar stronger than the connection to the car. The knuckle should be weaker than the coupling to the car, so that if any breakage occurred it would be something

that might be more easily replaced. If the knuckle does break, there is nothing to fall on the track to wreck the train. The present tail bolt is of such size and strength that it always breaks before the knuckle.

Mr. FORSYTH: Since I read the paper we have received from a number of coupler companies letters saying that they could fill the specifications proposed. Since our last meeting we have seen the result of some experiments which show incidentally the effect of the buffer block. At the recent brake test at Burlington the couplers were not protected by buffers, and we broke a number of bars and knuckles there when making stops. At the Lehigh Valley test they were protected by buffers, and no breakages of this kind were reported. This, I think, is a good argument for the use of buffers. I believe that the breakage of the arms, mentioned to-day, would be largely reduced if the coupler was protected by buffers. The point made by Mr. Sargent in regard to the failure of the knuckle and the tail bolt has only reference to the tensile resistance of each, but the fact is that most of these breakages are caused by blows delivered in the opposite direction, and if you make the knuckle so weak that it will break first, you will be troubled continually by the broken knuckles, as we have been in the past.

Endurance of Small Rail Heads.

The Rail Committee of the American Society of Civil Engineers made a progress report to the Society at the Annual Meeting of 1891. With that report Mr. J. D. Hawks presented diagrams showing the effect of wear on very thin rail heads. He secured his facts by planing off the standard rail of the Michigan Central and putting it in track on curves. Since he presented those facts to the society the experiment has been carried further, and we give herewith diagrams showing the results of wear.

In the case shown in fig. 1 half an inch was planed off the rail head and the rail was then put on the inside of a 13° 46' curve, March 25, 1889. It was in constant use for 1,020 days before the section was cut, which we show. During that time an average of 306 engines and 633 cars passed over it daily, making the total 312,120 engines and 645,660 cars. The diagram shows the original section of the rail, and the result of this very considerable service.

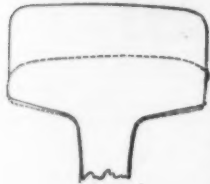


Fig. 1.

The rail shown in fig. 2 was treated in the same way; that is, half an inch was planed off the head. It was then put in on the outside of an 8° 18' curve, April 9, 1890. It was in constant service for 640 days and the total traffic over it amounted to 148,480 engines and 1,041,280 cars.

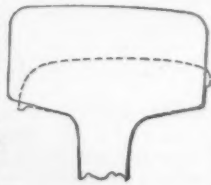


Fig. 2.

Fig. 3 is a more extreme case. In this instance $\frac{3}{4}$ in. was planed off the rail head. It was then put on a straight track Feb. 13, 1891, and had been in constant use 330 days at the time the templet was taken. The total traffic passing over it in that time amounted to 82,584 engines and 552,447 cars. The diagram shows the outline of the original section, of the rail after planing, and after it had been subjected to the above traffic.

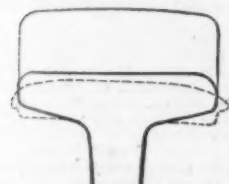


Fig. 3.

The heavy movement over all of these rails is accounted for by the fact that they were put in near Ross street, St. Thomas, Ont., where there is a good deal of engine movement to and from a round house, constant switching to and from car shops and a good deal of yard switching. The section shown in fig. 3 was perhaps subjected to even harder usage than either of the others, relatively to the number of movements over it, as there was a greater amount of switching and of sliding wheels over it. These three rails were put back in track after the templets were made. It has for a good while been the Michigan Central practice to make the rail head relatively small and to use unusually high carbon steel. The specimens which are shown seem to prove the capacity for endurance of rail heads made small enough to be thoroughly worked and of considerable hardness and tensile strength.

A New Suburban Engine.

Mr. L. B. Paxson, Superintendent of Motive Power of the Reading Railroad, has designed a new suburban engine with Wooten firebox for use in Chicago. It will be first tried on the Illinois Central road. Two of them have been built and they have just been put into service. They are intended to burn a very cheap grade of anthracite, which will be shipped by the Philadelphia & Reading Iron & Coal Company directly to the docks in Chicago by water.

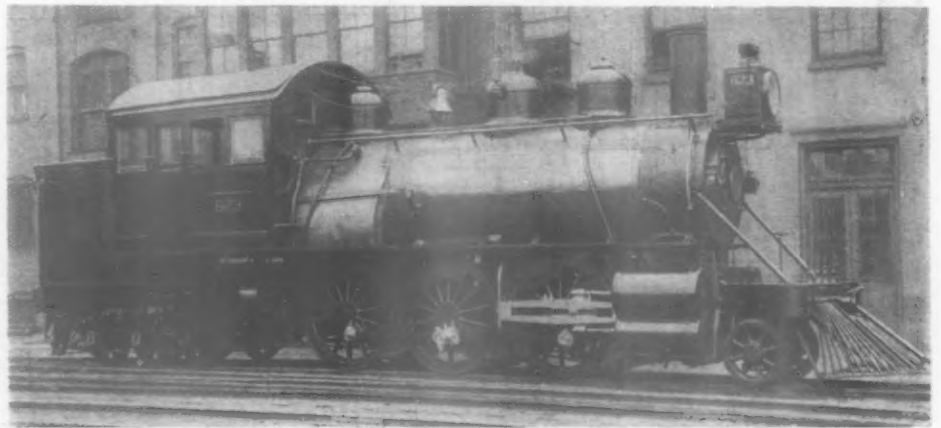
The general design of the engine is shown by the accompanying illustration. It has six drivers with a pony truck in front, and a six-wheeled truck under the tank, and differs from other Wooten engines in having the cab at the back end so that the fireman and engine man are together. The engine is compounded on the Vau-

claim system and has all of the latest improvements of the Reading engine which we illustrated recently, and some new features which we expect to show in more detail in a subsequent issue.

The railroad companies in the vicinity of Chicago are watching this engine with considerable interest, as it is hoped that it may prove to be what is needed to abate the smoke nuisance and prevent any further interference with the operation of the suburban roads on the part of the Chicago City Council.

The dimensions and some of the specifications follow:

Cylinders.....	12 in. and 20 in. x 24 in.
Drivers, diam.....	61½ in.
Total wheel base.....	35 ft.
Driving wheel base.....	11 ft.
Weight, working order, total.....	158,000 lbs.
Weight, working order, on drivers.....	91,000 lbs.
Boiler plates.....	steel, ½ in. thick.
Boiler, diam.....	60 in.
Working pressure.....	175 lbs.
Tubes.....	32½ in. diam., 9 ft. long.
Firebox.....	113½ in. long, 80 in. wide, 41¾ in. and 38¾ in. deep.
Truck wheels.....	6 in. with steel tires, 29¾ in. diam.
Driving wheels, diam.....	61½ in.
iron.....	centres, cast
Driving wheels, tires.....	5½ in. wide, ¾ in. thick, main pair plain.



Suburban Locomotive with Wooten Firebox.

Brakes..... Westinghouse - American on drivers and back truck; Ross-Meehan driver brake shoes.

Miscellaneous: Detroit triple feed lubricator; pistons solid with cast-iron packing rings; U. S. metallic packing for piston rods and valve stems; crossheads, cast steel; two 8½-in. Sellers' 1887 injectors; Westinghouse train signal.

A Railroad from Cartagena to the Magdalena.

The construction of the Cartagena-Magdalena Railway deserves to rank among the most important railroad enterprises undertaken within the past decade in South America, by reason of the far reaching results which will follow upon its completion. Its object is to connect the port of Cartagena with the Rio Magdalena by a line



Part of the Department of Bolivar, Colombia. Showing Line of Proposed Railroad from Cartagena to the Magdalena River.

52 miles in length, but to appreciate its importance the conditions affecting Colombian traffic must be reviewed.

The great centres of population in Colombia lie in the interior, with no outlet to the sea except by way of the Rio Magdalena. This remarkable river, flowing down from the mountains of Tolima, is navigable for vessels of 3½ ft. draft, between 600 and 700 miles, into the very heart of the republic, and constitutes the artery of commerce between the outer world and the coffee and mining districts of Santander, Antioquia, Tolima and Cundina-

marca. Connection between the centres of production and the river ports is maintained by mule trains across the mountains, and yet, in spite of these obstructions to free intercourse, the export and import traffic using the river amounts to 50,000 tons per annum. A further impediment to traffic is met at the mouth of the river, where the stream empties into the Caribbean Sea through a delta, whose several channels are obstructed by shifting sandbars, effectually precluding the entrance of ships.

Many years ago John C. Trautwine was employed by the Colombian Government to attempt to control one of these channels, and other engineers have subsequently been engaged upon this problem, but all with negative results. In consequence of this the Bolivar Railroad was constructed from Barranquilla, on the Magdalena, to Salgar, an open roadstead on the Caribbean. More recently, a pier is being built at Puerto Colombia, about 2½ miles southwest of Salgar, and the railroad has been extended to that point. This, however, is also an open roadstead, and is a perilous point for ships during the prevalence of the "nor'westers" which frequently rage along this coast.

Cartagena, on the other hand, possesses a magnificent land-locked harbor, and in the colonial days was the

port not only of Colombia, but of the entire western coast of South America as far as the northern confines of Chili. The products of the mines of Peru, of Ecuador, and of Colombia, came over the great mule road by way of Jaen, Cuenca, Quito, Popayan, and Quibdo, to Cartagena, whence they were shipped to Spain. By connecting a few creeks, lagoons, and bayous, the famous Canal del Dique was also constructed from Cartagena to the village of Calamar on the Rio Magdalena, a shallow waterway which is still open for a few months of each year and diverts a small portion of the Magdalena traffic to this ancient port. It has long been foreseen that the advantages of the splendid harbor at Cartagena would inevitably restore this city to its former position as the port of Colombia if it were connected with the Magdalena by a railroad. This is now to be done by a company of American capitalists who embarked in it at the instance of Mr. S. B. McConico, formerly of the Illinois Central Railroad, who conceived the project, obtained concessions from the government, and had the preliminary surveys and estimates made which demonstrated its feasibility.

Two corporations have been formed to carry this work into effect, the Cartagena Terminal & Improvement Co., Ltd., capitalized at \$1,200,000, with J. Murray Forbes, President; S. B. McConico, Vice-President and General Manager; Thos. R. Wheelock, Secretary and Treasurer; and W. D. Buckner, M. Am. Soc. C. E., Chief Engineer and Superintendent, and the Cartagena-Magdalena Railway Co., capitalized at \$1,800,000, and issuing six per cent. mortgage bonds to an equal amount, with Thos. R. Wheelock, President; S. B. McConico, Vice-President and General Manager; F. B. Beaumont, Secretary and Treasurer, and W. D. Buckner, Chief Engineer and Superintendent. The full amount of capital needed to complete the road has been provided.

Construction has already commenced, 10 miles having been graded up to date. Mr. Buckner sailed with a corps of engineers about two weeks ago for Cartagena, taking with him a cargo of construction equipment; and other engineers, with more materials, are to follow this week. A 20-ton Brooks "mogul" construction locomotive has also been ordered, together with 10 flat cars and three box cars for construction purposes. Bids have been solicited for six passenger cars and 100 freight and cattle cars, the woodwork of which is to consist entirely of selected highly resinous Georgia pine, a material which has been found to resist the effects of a tropical climate more effectually than any other wood in the world. Rails for the entire route, T-section, 45 lbs. to the yard, have been ordered, the first shipment of 2,200 tons being contracted to be made on April 25. Bids have been made by parties in Colombia to furnish ties of "guayacan," a native wood, allied to the lignum vitae, said to resist decay for 20 years, which will be accepted. The road is

to be well ballasted throughout with gravel, which exists at several localities along the line.

The route is laid out through a gently rolling country, crossing only one line of hills where the summit elevation, near the town of Turbaco, is 500 feet above tide, reached by a maximum grade of 1 3/4 per cent. The amount of material to be moved averages 10,000 cubic yards per mile. There will be 12,000 lineal feet of pile trestling, to be constructed of creosoted Georgia pine, and one 60-ft. iron draw span over the Canal del Dique.

The Terminal Company will begin in July next the construction of a wharf, at Cartagena, of creosoted Georgia pine, 660 ft. long by 92 broad, so built as to be capable of extension to meet the needs of traffic. Upon this wharf will be a warehouse, 500 ft. x 40 ft., also of creosoted pine, with a Fletcher coal tar roof. The minimum depth of water up to this dock is 26 ft. A floating dock is also to be built at the new port of Goenaga, on the Magdalena, and a machine shop is to be erected for the use of both companies at Cartagena within the coming year.

lished a description of this plant,* but little need be added at this time. The wheel foundry was started up less than a year ago, and has a present capacity of 200 wheels a day, which it is intended to increase to about 475 a day. Work was begun in the car department last October, the first cars being shipped early in November. The present capacity of the works is 25 freight cars a day, which will ultimately be increased to 50 per day.

The buildings shown on the plan are all finished and in use excepting the repair and paint shop, shown in dotted lines, for which the contract has been let. Altogether the works are an excellent example of modern practice in shop construction, arrangement and equipment for the rapid production of first class work. At present the works are engaged upon an order for 1,000 60,000-lb. cars for the Chicago, Burlington & Quincy Railroad.

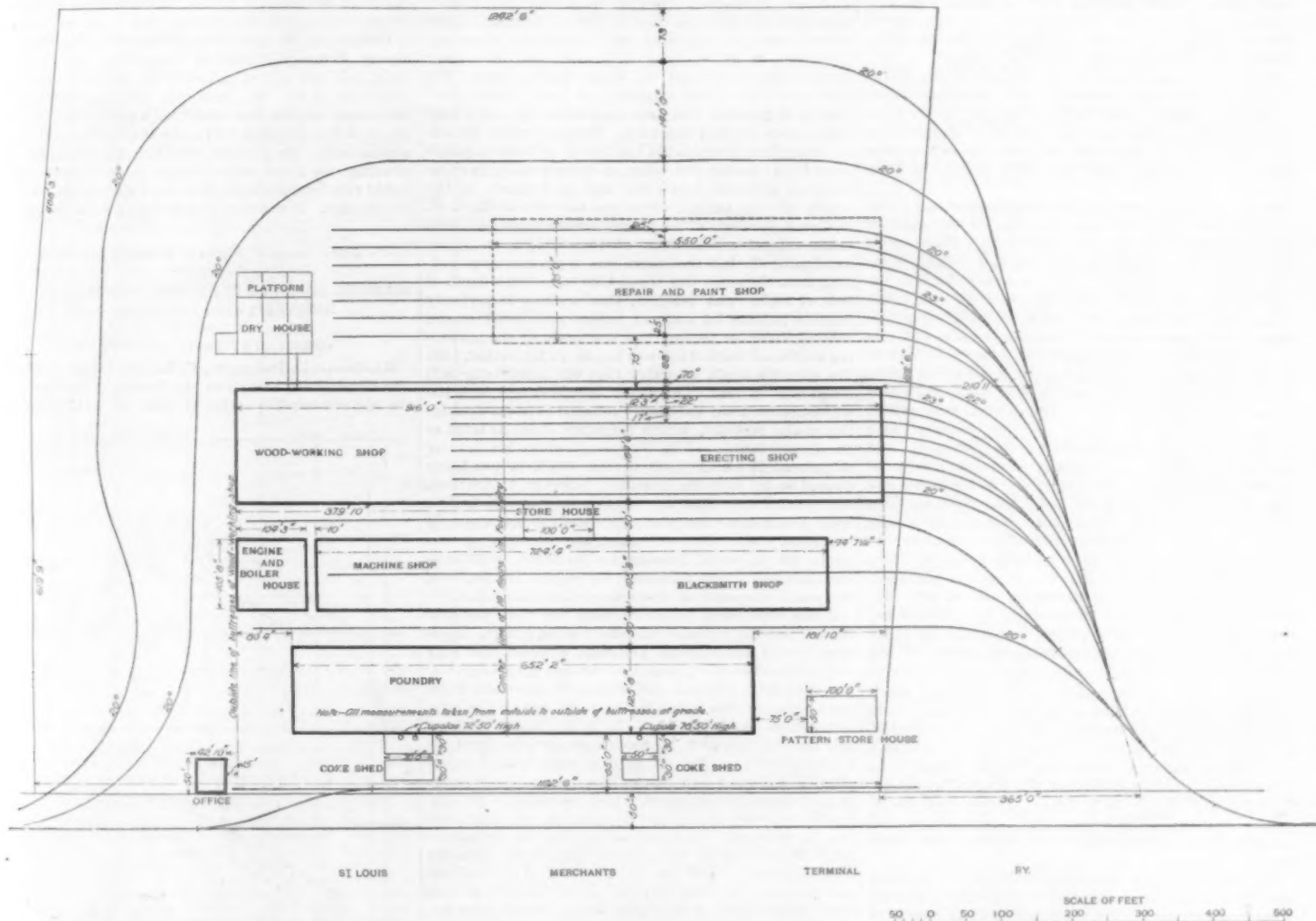
American Iron Mining in Cuba.

A party of American capitalists and mining experts returned a few days ago from a tour of inspection of the

building an artificial harbor at Sigua and a railroad to the mines; these are about completed.

The mine is approached by a railroad of standard gauge eight miles long. This road runs through the valley of the Sigua River, which is very narrow, extremely crooked and covered with a dense growth of trees and underbrush; so much so that the shortest sight could only be taken by cutting through the brush. The first location of the road crossed the river 14 times, but on revision these crossings were reduced to three, and the railroad fitted into the valley of the river so neatly that it now looks as if it could have gone in no other place. This work was carried out by the Chief Engineer, Mr. Miller A. Smith.

The road starts from the ore dock at the port of Sigua, and runs to the foot of the hill on which are located the mines. At the port is a large flat where the river empties into the sea, 900 ft. wide, and one mile long, making a fine place for the railroad yards, and giving ample room for all the tracks necessary for the transportation of large quantities of ore. The switches are so arranged



Madison Car Works—Plan of Property, Buildings and Proposed Connections with the St. Louis Merchants' Terminal Railway.

It has been incorrectly stated that among other improvements to the harbor of Cartagena the opening of the old channel, known as the Boca Grande, would be necessary. This proves to be unfounded. Contrary to the prevalent story that this channel was closed by the Spaniards as a protection against the buccaneers, it turns out that the real object was to protect the harbor from being silted up from the action of the heavy seas which swept into it during storms. Through Boca Chica, the present entrance, is a permanent channel 500 ft. wide with a minimum depth of 30 ft.

The stimulating effect of this enterprise is already becoming felt. Various new commercial ventures have been undertaken at Cartagena, a fruit company has acquired a tract of land in the district traversed by the road, intending to cultivate bananas and cacao, and a mine of bituminous coal near the line of the road is to be opened this year. More than this, the certainty that Colombian commerce will be favored with a good harbor and adequate terminal facilities, which will further reduce the costs of transportation, has encouraged the construction of other roads. One project, already assuming definite shape, is to continue the road from Cúcuta, to Villamizar on to the Magdalena at Tamalameque, a distance of 95 miles.

The Madison Car Works.

The accompanying illustration clearly shows the general arrangement of these works which are located at Madison, Ill., which is the eastern terminus of the St. Louis Merchants' Bridge. As we have already pub-

lished the Sigua Iron Co., on the south coast of the island of Cuba. In the party were Mr. S. H. Chauvenet, President, and several directors and officers of the company, and a representative of *The Railroad Gazette*. They devoted six days to the examination of the mines and plant of the Sigua Co., and four days to an inspection of the properties of the Juragua Iron Co. and the Spanish American Co., which lie to the westward of the Sigua territory.

The latter consists of an estate of 60,000 acres, and is located at the port of Sigua, on the Caribbean Sea, 26 miles east of Santiago de Cuba. There are about a score of mines on the estate, all yielding Bessemer ore. No development has been done on the mines beyond the sinking of test pits to ascertain the extent of the deposits. These were satisfactory, and the property was purchased two years ago by a syndicate composed chiefly of American capitalists. Mr. W. J. Rattle, of Cleveland, made the first report on the ore deposits, and declared the mineral itself high grade Bessemer, and estimated that 1,200,000 tons were actually in sight. The outcrops are enormous, and all of the test pits continued in ore as deep as they were sunk. The Sigua Iron Company was formed with a capital of \$5,000,000, and orders were at once given to proceed with the work of equipping the property with a plant that would handle an output of 400,000 tons a year. Careful examinations convinced the company that there was sufficient ore in sight to justify the expenditure of \$1,000,000, and nearly that amount has been paid out. The most expensive operations were

that cars can be taken either to the top of the ore dock, which is 50 ft. above the sea, or to the unloading wharf for ordinary freight, which is on the sea level. The tracks also run to the hospital, and to the large quarries from which stone for the masonry work of the bridges was procured. At present there is in the yard a system of tracks of 3 ft. gauge, which is operated by a 14-ton locomotive, and 75 or 80 dump cars. These are used for building the breakwater, and filling the crib upon which the ore dock is built. At this point also is located the saw mill which is used for sawing wood for fuel in the locomotives. A roundhouse is already built, and a large shed in which bituminous coal is kept for use in hoisting engines and a sea-going steam tug. Eventually, all the engines will be coal burners. The terminal facilities at this point are excellent, and capable of being greatly enlarged, so that the business of a large port can be easily handled, as far as railroad facilities are concerned. At each end of the line is a turntable built by the Pencoyd Iron Works.

The water for the locomotives is furnished from two large tanks, the water being pumped into them from a well close at hand. Two tanks are employed for the purpose of settling the water, which is heavily charged with lime. The elimination of the lime is accomplished by putting soda ash in the water of the first tank, stirring it up with a steam jet, and after the lime is precipitated, drawing off the water into the second tank, from which the engines take their supply.

In order to make more yard room at the upper end of the yard and to save two river crossings, the channel of the Sigua River was changed for a distance of half a

* See *Railroad Gazette*, July 17, 1891.

mile. This was done with a Souther steam shovel, the gravel from the excavations being used for ballast and for filling the crib on which the ore dock stands. In many places embankments were made from the material furnished by the steam shovel.

The maximum curves of the railroad are 24 degrees and the maximum grade 3.4 per cent. for the distance of $\frac{3}{4}$ mile. The grade, however, is descending from the mines to the ore pier. Most of the cuts are in rock, and banks are very secure against floods in the Sigua River, which are apt to occur during the rainy season. The deepest cut on the line is 50 ft. with a length of 200 ft. Several of the curves make 180 degrees of curvature, which shows the crooked nature of the Sigua Valley.

At the New Philadelphia station the railroad leaves, the Sigua River, and follows the San Gabriel to its head waters, striking the Sigua River again at bridge No. 2. At this bridge the name of the river is changed to the Julia, and this stream is followed up to the mines, which are eight miles from the ore pier. The bridges are plate girders 60 in. deep and 50 ft. span, except bridge No. 2, which has two 25 ft. spans and two 50 ft. spans, the centre spans being carried on iron towers resting on masonry piers. Bridge No. 3 has two 50 ft. spans, and bridge No. 1 has three 50 ft. spans.

There are no stone culverts on the line, all the drains being made with 18 in. and 20 in. terra cotta pipe. There is only one trestle, which is 15 ft. high and 100 ft. long. The piers of the bridges are built of white marble from the quarry at the coast, and are first class masonry, some of the coping stones being 4 ft. square and 18 in. thick.

Seven miles from the coast is the mining village called "Chalia," at which point are also located the railroad shops, foundry and blacksmiths' shops. These shops are at present in course of erection, and will be sufficiently large to do all repair work necessary for the railroad and the mines. The machine shop will be fitted to do any work necessary for repairs of locomotives and cars. The carpenters' shops for repairs to cars will also be at this point, and eventually all mine cars will be built by the company from the native wood which grows on its estate. All of this wood is very hard, much of it being the lignum vitae. The scrap iron which accumulates will be used in the foundry with a little pig iron imported for the purpose, and ordinary castings for repairs will be made in the company's shops. Here, also, are water tanks and turn tables. The water from these tanks is brought in a 5-in. pipe from a point in the Julia River, half a mile above the mines, and high enough above to supply the tanks and the village of Chalia without pumping. It is the intention to continue this line of pipe to the coast, so as to give a supply of good water, and to give hydraulic power on the pier for handling ore. The elevation of the point above the mines from which the water is taken to the ore pier is about 800 ft. above tide water.

The yard at the mines is so arranged that cars can be run up to the foot of the incline by gravity, and when loaded, dropped away from it in the same way, there being ample room for standing cars as fast as loaded, and these can then be taken to the ore dock as fast as a train load is made up. There is altogether about three miles of siding in this yard, and the tracks can be extended at any time so as to make loading facilities as great as required. The houses for the men are at this point, and most of them will live here with their families.

The village is situated on the Julia River, on a lovely plateau, and with good water, pure air and an elevation of 600 ft. above the sea, the conditions for the health of the employes is believed to be assured. This is a primal factor in the successful operation of these big enterprises in Cuba, and the Sigua Co. has devoted much attention and money to the subject.

The mine railroad, which is on the mine 300 ft. above the main line, is a three-foot gauge operated by narrow-gauge engines, and universal dump cars. This line is laid with 30-lb. rails, and ties of native wood, which are so hard that at times it is difficult to drive a spike into them, and a hole has to be made with an augur. After the spike is once put into this kind of timber it never gets loose until the timber is destroyed. This railroad is a mile long, with sidings at each of the ore openings for standing cars to be loaded, and runs to the head of the incline which takes the ore to the broad-gauge cars below. The water for the use of the engines and for mining operations is pumped from the lower level by a small Worthington pump. This road is a side hill cut all the way, and the grade of the road really opened up the mines ready for mining ore. In many places the road was cut through solid ore containing 66 per cent. of iron.

The main line of railroad is equipped with 60-lb. steel rails manufactured by the Pennsylvania Steel Company. Much of the iron used in these rails was made from Cuban ore, which came from the mines adjacent to the Sigua mines, and owned by the Pennsylvania Steel Company and the Bethlehem Iron Company. The cross-ties are of Georgia yellow pine.

The equipment consists of five locomotives, one 50-ton six-wheel locomotive with a swallow-tail tank; one four-wheel tank locomotive, and two 50-ton mogul engines, all built by the Baldwin Locomotive Works of Philadelphia and specially designed for taking the sharp curves and heavy grades which they will meet on the

road. Engine No. 5 is a narrow gauge for use on the mines. There are 22 flat cars and 100 ore cars, all of 40,000 lbs. capacity. The ore cars are built from plans furnished by the Duluth, South Shore & Atlantic, and is the car used by that road in transporting Lake Superior ore to the docks at Marquette and is considered by them the best car they have ever used. The cars have bottom dump and are so arranged that no ore has to be shoveled out of them. These cars were all built by the Carlisle Manufacturing Company of Pennsylvania and transported to Sigua without being taken to pieces.

The equipment will be increased from time to time as the development of the mines warrants, but with the descending grade from the mine to the pier the amount of equipment already on hand will handle 300,000 tons of ore per year.

The ore dock, which was built by Anderson & Barr of Jersey City, situated in the harbor at Sigua, is approached by a trestle 400 ft. long, resting on a stone embankment. The foundation of the pier is built of palmetto cribs, into which piles are driven through 14 ft. of sand to the rock below for the support of the superstructure, and the cribs then filled with broken rock and gravel, making a very solid and substantial structure. This pier is 381 ft. long, 42 ft. wide and 32 ft. deep, giving a depth of water its whole length of 29 ft. The pier itself is the Lake Superior ore dock pattern, containing 25 pockets. The total capacity of the pier is 3,000 tons, or one average ship load. This pier can be extended to any length desired in the future, as there is ample room in the harbor for doing so, or for putting in other piers at different locations. The pier stands in the centre of the harbor, which was laid out by Capt. D. B. Green, formerly of the United States Engineers, who made extensive soundings of the bottom at Sigua, developing the fact that there was a gradual slope running from the shore line about 3,000 ft. before a depth of 50 ft. of water was reached, thus making it perfectly feasible to build an inclosed harbor with breakwaters. A breakwater for turning the sea made by the prevailing southeast trade wind was begun in November, 1890. The extreme depth of water that the breakwater will stand in is 36 feet. The stone for building it is the white marble from the quarry referred to in the description of the railroad, which furnishes stone as large as the derrick is able to lift. The length of the breakwater at present is about 1,000 ft., but work is not being pushed on it. It is the intention, however, to continue this breakwater 1,200 ft. further, and also to build a west breakwater for protection against any south or southeast wind. This will make the entrance to the harbor 300 ft. wide, forming an inclosure of 60 acres and affording a safe anchorage for ships. The depth of the water over most of the harbor is from 25 to 36 ft.

It was considered advisable when the work was first started to bring laborers from the United States. These were mostly Italians with American foremen, and they did excellent work. From time to time they were reinforced by other Italians, and later by Hungarians, Poles and Germans. The latter, however, did not give as good satisfaction as the Italians. It is the intention from this time on to import no more common labor from the United States, but depend entirely upon Spanish labor, which is imported from Spain into Cuba at the expense of the Spanish Government, which encourages emigration in this way, and by careful selection very fair labor can be procured. In addition to this, the Spaniards adapt themselves to the climate much better than any other nationality, and are already used to the customs and language, so that they are much better workmen from many points of view than those of any other nationality for work in Cuba. All carpenters, machinists, tracklayers and other skilled laborers required in construction work were, of necessity, brought from the States, as there is no demand in Cuba for this class of labor.

The Sigua Company expects to begin shipping ore during the summer, and from the appearance of the mines can ship a large amount from the start.

The executive staff stationed at Sigua is composed as follows: Miller A. Smith, Chief Engineer; S. Cameron Corson, Assistant Engineer; T. E. Huffington, Auditor; John Vallance, Mine Captain; J. E. Whitfield, Chemist, and Dr. H. Caminero, Physician in charge of the hospital. The officers of the company are: S. H. Chauvenet, President; Thomas H. Graham, Vice-President; J. S. Singer, Secretary and Treasurer.

The expedition went from Sigua to Santiago on the company's tug and on the following day visited the property of the Juragua Iron Company, which is located 17 miles up the coast from Santiago. The loading pier is in Santiago Bay, opposite the city, and is reached by a narrow gauge railroad that runs along the coast to the mines. This company began operations in 1884 and is controlled by the Bethlehem Iron Company and the Pennsylvania Steel Company, whose furnaces consume the entire output of the mines. Since operations began the company has expended on plant and expenses \$2,500,000, and the output of ore since the first shipment has been 1,448,403 tons. The main line of the railroad is 17 miles in length and in addition to this are 17 miles of sidings and mine tracks, making 34 miles in all. There are some heavy grades and sharp curves between the loading pier at La Cruz and the mining town of Forneza, and to surmount these obstacles it is necessary to divide the ore trains about half way be-

tween the mines and the loading pier. The shops are located at Siboney Bay about 12 miles from Santiago. At this point is a well equipped machine shop, where all repairs to the locomotive and cars are made and a foundry where all necessary castings and the mine machinery are made. The mining village consists of a large store and dwellings for about 2,000 people. The equipment of the railroad consists of 20 locomotives and 2,000 ore cars. The entire road and its equipment are in excellent condition.

The property of the Spanish-American Mining Company, which was also visited by the Sigua people, is located five miles east of the Juragua mines. Operations on this property were begun shortly before the Sigua Company began work. The mines, which have been well developed and show fine Bessemer ore, are located $4\frac{1}{2}$ miles back from the coast. They are reached by a railroad of standard gauge. The grading has been completed, but there are still two miles of track to be laid and several bridges to be built.

The ore will be brought to the railroad from the mine openings by inclined planes, which will be worked by gravity. Considerable difficulty has been encountered in building an ore dock at the artificial port at the coast. Messrs. Anderson & Barr, of Jersey City, have the contract, but the dip of the rock in the harbor makes it a hard one to fill. Mr. Anderson, who has been in Cuba for several months, has submitted a plan to the company which, if it is adopted, will make the building of a pier unnecessary. He proposes building an elevated steel structure on shore with storage pockets from which would run flexible chutes to a vessel anchored a hundred feet distant. It is a new idea and may be adopted.

Time Tests of Natural Cement Mortars.

RELATIVE STRENGTH OF CRUSHED QUARTZ AND SAND MIXTURES; ALSO EFFECTS OF SALT.

COMPILED BY PROF. J. B. JOHNSON.

Mr. Garnet D. Baltimore, C. E., in a recent number of *The Polytechnic*, has given the results of a very elaborate and remarkable series of tests of natural cement

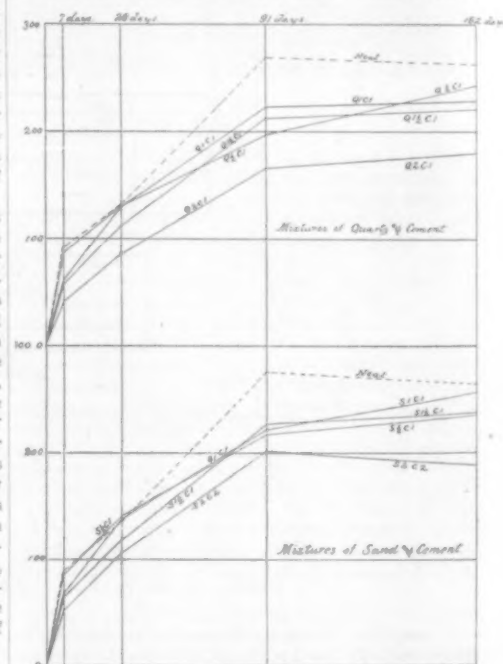


Fig. 2.—Mean Results for Two Brands of Cement with Saturated Solution of Salt.

Time Tests of Natural Cement Mortars.

mortars made by him while in charge of the cement testing department of the New York State canals. These tests show the effect of mixtures of No. 4 crushed quartz, as recommended by the committee of the Am. Soc. C. E. in 1885, of coarse sand, and of medium sand, each in the proportions of $\frac{1}{4}$ to 1, $\frac{1}{2}$ to 1, $\frac{3}{4}$ to 1, 1 to 1, $1\frac{1}{4}$ to 1, $1\frac{1}{2}$ to 1, $1\frac{3}{4}$ to 1 and 2 to 1, as compared to the strength of neat cement, with each of three different brands of cement, and for periods of one week, four weeks, three months, six months and one year. Also time tests for two years with two different brands of cement and two kinds of sand, one of which was crushed quartz, the proportions being 1 to 1. Also the strength of mortars made with saturated solutions of salt with two brands of cement, and two kinds of sand, one of which was quartz, for periods of one week, four weeks, three months and six months. The whole series included several thousand tests, and is probably the most complete series ever made along these lines.

The cements are described as follows, presumably all being natural cement from the Rosendale district.

No. 1. A light colored brand, well ground, with a noticeable trace of lime.

No. 2. A quick setting cement, not perfectly ground.

No. 3. A representative Rosendale brand.

The samples were selected from 20 or more various shipments in 1890.

The crushed quartz was the No. 4 grade, being such as to fulfill the requirements laid down by the committee, that it should pass No. 20 sieve and be caught on a No. 30.

"The coarse sand used, a mixture of quartz and decomposed shale, is known as the Pattersonville sand.

"The medium sand was sharp, entirely free from loam, and composed almost entirely of quartz, and is known as the South Ballston sand.

"The briquettes were made as follows: The proportions were carefully weighed upon a Fairbanks scale, selected so as to keep the aggregate as near 10 oz. as possible, 5 oz. being required for each briquette. The components were placed in shallow pans and thoroughly mixed dry. As a rule thirteen pans were used, making twenty-six briquettes for each test.

"Then an experimental briquette was made in each

3. That for periods of six months or more for coarse sand and crushed quartz mixtures, a proportion of one-half sand to one cement gives the maximum strength, but that all mixtures up to two sand to one cement exceed in strength the neat cement. For medium sand all mixtures up to one to one exceed in strength the neat cement.

4. That the neat cement exceeds in strength all mixtures with sand or quartz on a seven day test, and with medium sand on the twenty-eighth day test also, but after these periods the sand mixtures rapidly pass the neat cement in strength, until at the end of one year the facts are as stated in 3.

5. For the quartz sand and the medium sand the strength of a mixture of one-half sand to one cement is about 50 per cent. more than a mixture of two sand to one cement, at the one year period, while for the coarse

cars broke away from it and ran back into the rear portion of the train, wrecking seven cars.

1st, on New York & New England, near Hancock, Conn., a wrecking train which had stopped to get a rail was run into at the rear by a following passenger train, doing considerable damage and injuring the engineer.

1st, on Lake Shore & Michigan Southern, at Elmore, O., a fast freight train ran into the rear of a local freight, wrecking several cars and injuring 3 trainmen.

4th, on New York Central & Hudson River, at Karkers, N. Y., a freight train ran into a yard engine, badly damaging both engines and injuring one engineer.

5th, on Pittsburgh, Fort Wayne & Chicago, near Warsaw, Ind., a freight train which had been stopped by a preceding freight was run into at the rear by a following freight wrecking the engine and 7 cars. The conductor of the foremost train was killed.

6th, on Lake Shore & Michigan Southern, near Toledo, O., passenger train ran into the rear of a preceding freight train, wrecking 1 freight car. The conductor of passenger train was injured.

7th, on Philadelphia & Reading, near Weston, N. J., freight train ran into the rear of preceding freight making a bad wreck which blocked the road several hours. A fireman was killed.

12th, on Leigh Valley road, at Aurora, N. Y., a snow plow ran into the rear of a freight train ahead of it, wrecking 4 cars. A brakeman who jumped off in a cut fell back upon the track, and was killed. The snow plow followed the freight train too closely from the last preceding station.

12th, on Pittsburgh, Fort Wayne & Chicago, near Wood's Run, Pa., a freight train ran into the rear of a preceding freight, injuring 2 brakemen.

18th, on Pennsylvania, at Mount Carbon, Pa., a freight train ran into the rear of a mixed train, damaging the engine and several cars. Several passengers injured.

19th, on New York, Chicago & St. Louis, near Erie, Pa., a freight train ran into the rear of a preceding freight, wrecking an engine and 20 cars. A fireman was killed and 2 other trainmen were injured. It is said that the flagman of the foremost train did not go back far enough.

20th, on Housatonic road, near Wilton, Conn., a milk train ran into the rear of a local freight, wrecking 15 cars. Engineer killed and 2 other trainmen injured. It is said that the engineer of the milk train, who was running about 30 miles an hour, failed to see a signal which was shown for him.

20th, midnight, on Cleveland, Cincinnati, Chicago & St. Louis, near Indianapolis, Ind., an express train ran over a misplaced switch and into some freight cars standing on the side track. A man and a woman on the front end of the mail car (both tramps) were killed.

20th, on Philadelphia, Wilmington & Baltimore, at Cheswold, Del., passenger train ran into the rear of a preceding freight, wrecking the caboose and derailing 2 freight cars. The engineer was injured. There was a dense fog at the time.

23d, 1 a. m., on New York Central & Hudson River, near West Albany, N. Y., a freight train waiting to enter the yard was run into at the rear by a following freight, wrecking the caboose and killing a brakeman.

24th, on New York Central & Hudson River, at Auburn, N. Y., freight train ran into the rear of a preceding freight, wrecking the caboose and killing a fireman who was inside eating his supper.

24th, on Grand Rapids & Indiana, at Paris, Mich., a freight train ran into the rear of a preceding freight badly damaging 10 cars. A driver was injured.

24th, 4 a. m., on Wabash road, near Columbia City, Ind., a freight train ran into the rear of a preceding freight killing a fireman.

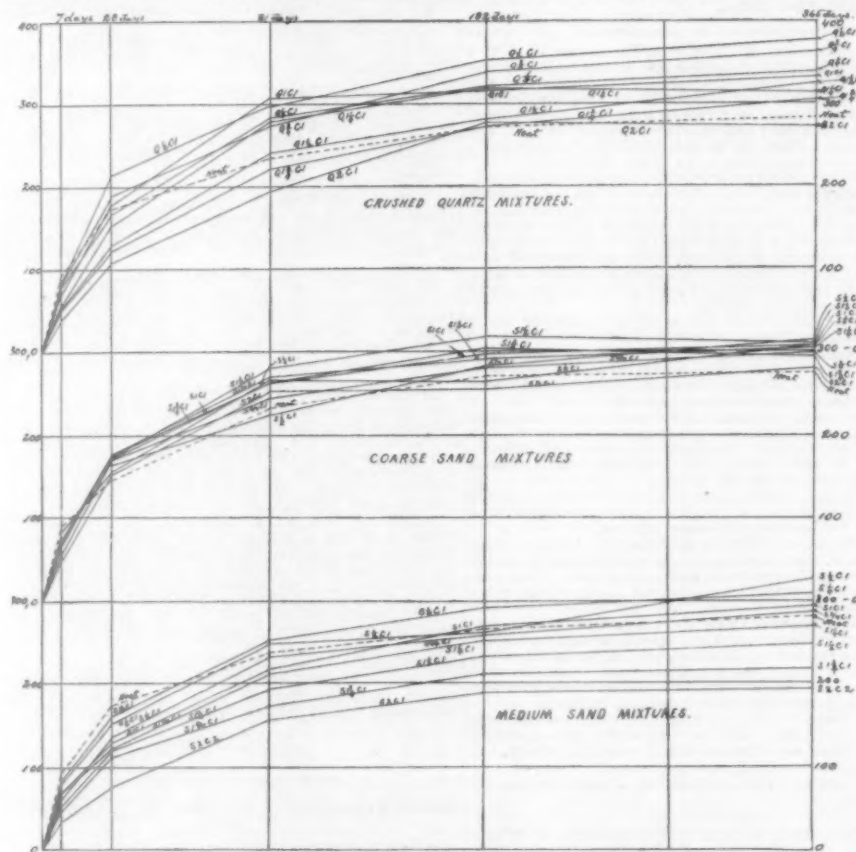
24th, on Savannah, Florida & Western, at Live Oak, Fla., a passenger train ran over a misplaced switch and into a car standing on a side track, badly damaging the car and injuring the fireman.

26th, on New York & New England, at Hyde Park, Mass., an eastbound passenger train which had just been run upon the main track preparatory to starting for Boston, was run into at the rear by an express train, badly damaging the two rear cars, which, however, were empty. There was a dense fog at the time.

26th, on Mississippi River Bridge, at East St. Louis, Ill., a passenger train of the Jacksonville Southeastern Line ran into the rear of a Mobile & Ohio passenger train, derailing a portion of each train. There was a dense fog at the time. A mail clerk of the foremost train was injured.

26th, on Norfolk & Western, at Suffolk, Va., passenger train ran into a freight train standing on the side track, apparently because a switch had been left wrong, injuring 2 trainmen and several passengers.

28th, on Chicago, Milwaukee & St. Paul, near Spring



12th, on Pittsburgh, Fort Wayne & Chicago, near Lawrence, O., butting collision between freight trains, both running at considerable speed, wrecking 7 cars and damaging both engines. One fireman was injured. It is said that conflicting orders concerning the meeting point were given.

20th, on Norfolk & Western, near Petersburg, Va., butting collision between freight trains, wrecking the engines and 25 cars. A brakeman and a man stealing a ride were killed, and 3 trainmen were injured. It is said that the conductor of the westbound train ran contrary to orders.

25th, on Pittsburgh, Virginia & Charleston, at West Elizabeth, Pa., freight train ran over a misplaced switch and into the head of a freight train standing on the side track, wrecking 20 empty coal cars, one of which went across an adjoining street and into a drug store, where a man and a girl were injured.

25th, on Cincinnati, Lebanon & Northern, near Norwood, O., collision between a northbound accommodation train and a southbound passenger train of the Cincinnati, Portsmouth & Virginia road, causing injuries to one trainman which are reported as fatal.

And 6 others on 6 roads, involving 2 passenger and 10 other trains.

CROSSING AND MISCELLANEOUS.

6th, on Louisville, New Orleans & Texas, at Sauve, La., a freight train backing into a side track was run into by another freight, making a very bad wreck and injuring 2 trainmen.

7th, on Pennsylvania road at Watts, Pa., an eastbound freight ran into a switching engine, wrecking 5 cars and injuring an engineer.

9th, on Pennsylvania Railroad, near Columbia, Pa., a passenger train ran into a freight train which was just leaving the main track but had not wholly cleared it, damaging this engine and wrecking the smoking car. A passenger was injured by jumping off.

12th, on Chicago, Rock Island & Pacific at Shorey, Kan., a passenger train ran over an unfastened switch and struck a freight engine standing on a side track. Both engines and several cars damaged and one engineer injured.

12th, on New York Central & Hudson River, at Brighton, N. Y., mail train No. 11 ran into passenger train No. 5 as it was entering the main line from the Auburn division, badly damaging a sleeping car and derailing the engine and 2 cars of the mail train. There were only 3 passengers in the sleeping car, of whom one was injured. It is said that the signal was against the mail train.

15th, on Kings County Elevated in Brooklyn, N. Y., a train of empty cars was backed into the locomotive of a standing passenger train, injuring the fireman.

20th, on Missouri Pacific, at Kirkwood, Mo., collision between a passenger train and a switching engine, injuring 5 passengers, one of them fatally.

24th, on Pennsylvania, in Philadelphia, Pa., the engine of a freight train collided with some cars standing on a side track, causing the rupture of the firebox, which resulted in the fatal injury of the fireman by scalding. Three other men were less severely hurt.

24th, at the Union Depot, at Cisco, Tex., collision between a Texas & Pacific freight and a Texas Central passenger train. Two passengers were injured.

25th, 5 a. m., on — road, at Palestine, Tex., a freight train backing upon a side track was pushed over a misplaced switch and into some cars, causing the death of two car inspectors riding in the caboose.

28th, on Florida Central & Peninsular, at Ellaville, Fla., a passenger train ran into a carload of logs, injuring the engineer.

29th, on Lake Shore & Michigan Southern, at Harbor Creek, Pa., a freight train backing into a side track collided with another freight, overthrowing the caboose. A driver was badly injured.

And 11 others on 11 roads, involving 7 passengers and 13 freight and other trains.

DERAILMENTS.

DEFECTS OF ROAD.

1st, on East Tennessee, Virginia & Georgia, near Oliver Springs, Tenn., the passenger car of a special train carrying convicts was derailed and partly overturned by the spreading of the rails. The convicts, of whom there were 50, were fastened to a chain extending the length of the car through the middle, and their fright was therefore unusually great, but it is said that none of them were hurt.

3d, a. m., Baltimore & Ohio, at North Baltimore, O., a fast train of express cars (not passenger) was derailed, while running at high speed, by the breaking of a switch-rod. The whole train was badly wrecked; the engineer was killed and fireman badly injured, and two express messengers were slightly injured.

3d, on Burlington & Missouri River, at Lincoln, Neb., the engine and several cars of a freight train were derailed at a broken switch. Engineer killed.

5th, on Carolina Midland road, near Blackville, S. C., a passenger train was derailed by a broken rail, 2 passenger cars being badly wrecked and all the passengers in one of them injured, except one. Nine passengers in all were injured.

5th, on Ohio & Big Sandy, near Waldrige, Ky., mixed train derailed by spreading of rails, the passenger car tumbling down a bank and being partly burned up. Conductor and 4 passengers injured.

6th, on Housatonic road, near South Norwalk, Conn., the engine of a freight train was derailed by the spreading of the rails on a curve.

8th, on Great Northern, near Conway, N. Dak., mixed train derailed by the spreading of the rails, 2 passengers being injured.

10th, on Philadelphia, Wilmington & Baltimore, near Franklin, Md., passenger train derailed by a broken rail, a passenger car being overturned. Several passengers were injured. The wreck caught fire, but the flames were soon extinguished.

11th, on Lake Shore & Michigan Southern, near Kendallville, Ind., a fast eastbound freight train was derailed, 6 cars being wrecked and a brakeman killed. Engineer and fireman slightly injured. It is said that a broken switch was the cause of the derailment.

12th, on Toledo & Ohio Central, at Pleasantville, O., freight train derailed by a broken rail, 20 cars being wrecked. Engineer, fireman and a brakeman killed.

18th, on New York Central & Hudson River, near 70th street, New York City, in the Fourth avenue tunnel, the engine and 4 cars of a southbound passenger train of the New York, New Haven & Hartford were derailed by a broken rail, doing considerable damage and obstructing the adjoining northbound track.

And 13 others on 13 roads, involving 7 passenger and 7 freight and other trains.

DEFECTS OF EQUIPMENT.

2d, on Chicago & Alton, near Joliet, Ill., the engine of

a freight train was wrecked by the explosion of its boiler, 3 cars being derailed. The fireman and 1 brakeman were killed and the engineer injured.

8th, on Grand Trunk, at West Bethel, Me., freight train derailed by the falling of a brakebeam, 15 cars being ditched. The conductor was injured.

11th, on Fitchburg road, at Ayer, Mass., a freight train was derailed on the bridge over the Nashua River and 24 cars fell into the stream. The bridge was badly damaged, and the conductor was killed. It is said that a broken truck caused the derailment.

20th, on Alabama & Vicksburg, near Forest, Miss., a construction train was derailed and wrecked by the breaking of a car, killing 2 laborers and a foreman. The conductor and 2 brakemen were injured.

21st, on Louisville, New Orleans & Texas, near Natchez, Miss., the passenger car of a mixed train was derailed and overturned by a broken draw bar, which was pulled out of a freight car. Two passengers and one employee were injured.

And 16 others on 8 roads, involving no passenger and 16 freight and other trains.

NEGLIGENCE IN OPERATING.

3d, on Baltimore & Ohio, near Piedmont, W. Va., a freight train became uncontrollable in descending a long grade and after running several miles at high speed was derailed near the bridge over the West Virginia Central & Pittsburgh roads, and the engine and 18 cars went down on to that road and into the Potomac River. The fireman was killed. It is said that the breaking of a wheel was the immediate cause of the derailment.

4th, on Florida Central & Peninsular, at Island Grove, Fla., a freight train was derailed by an unfastened switch, the engine and several cars being badly damaged. The fireman was killed and the engineer badly injured.

21st, on New York & New England, at East Hampton, Conn., a westbound passenger train was derailed at a switch which was thrown by a careless attendant after a part of the train had passed over it. A passenger who jumped off was badly injured.

And 8 others on 6 roads, involving 2 passenger and 6 freight and other trains.

4th, on Southern Pacific, at Baden, Cal., a passenger train ran over a switch which had been maliciously misplaced by tramps, slightly damaging the engine and several box cars standing on the siding.

14th, on Gulf, Colorado & Santa Fe, near Brenham, Tex., engine and 5 cars of a passenger train derailed, 3 cars being overturned. One passenger was seriously injured. It is said that a piece of a drawbar had been maliciously fastened on the track.

19th, on Union Pacific, near Salt Lake City, Utah, 4 cars of a passenger train derailed and overturned at a washout. Two passengers were injured.

19th, on Fremont, Elkhorn & Missouri Valley, near Smithwick, S. Dak., a mixed train was derailed by cattle on the track and 6 cars were badly damaged. The conductor and a passenger, the only one on the train, were fatally injured.

20th, on Baltimore & Ohio, at White Hall, Pa., a passenger train, running at high speed, struck some obstruction on the track, derailing the engine and tender, both of which went down a high bank; but the cars remained on the track, running some distance past the engine. Engineer killed and a fireman injured.

20th, on Pennsylvania, at Sunbury, Pa., several cars of a freight train were derailed and badly damaged by a beer keg, which was thrown or fell upon the track. It is said that the wrecking was malicious.

And 8 others on 8 roads, involving 5 passenger and 3 other trains.

UNEXPLAINED.

1st, on Lancaster, Oxford & Southern, near White Rock, Pa., a passenger train was derailed and one of the passenger cars was thrown down a bank, where it caught fire and was burned up. There was but one passenger in it, who was seriously injured, but escaped the fire.

8th, on Missouri Pacific, at St. Louis, Mo., a switching engine was derailed and ran into a freight car standing on an adjoining track. Fireman injured.

18th, on San Antonio & Aransas Pass, near Houston, Tex., a yard engine which had been sent some 6 miles out on the road was derailed and overturned, killing the engineer. There were a number of persons riding on the engine by invitation, of whom 1 was killed and 3, including a woman, injured. The fireman was also injured.

20th, on Burlington, Cedar Rapids & Northern, near Lynn Junction, Ia., Chicago, Milwaukee & St. Paul freight train was derailed on or near a bridge and eight cars were wrecked.

24th, on Lake Erie & Western, near Portland, Ind., a freight train was derailed and 14 cars went off a bridge into a river.

26th, on Louisville & Nashville, at Lynnville, Tenn., four cars of a freight train was derailed, injuring the conductor and one brakeman.

29th, on East Tennessee, Virginia & Georgia, near Atlanta, Ga., a southbound freight train was derailed and 12 cars badly wrecked. A tramp stealing a ride was injured.

And 38 others on 29 roads, involving 12 passenger and 26 freight and other trains.

OTHER ACCIDENTS.

8th, on Philadelphia & Reading, in Philadelphia, Pa., an engine pushing a freight train was wrecked by the explosion of its boiler. The fireman, 1 brakeman and 2 boys riding in the caboose were killed and 3 other trainmen injured.

18th, on Southern Pacific, near Poso, Cal., a passenger train ran over a can of gasoline which had been dropped from a preceding train, setting fire to the woodwork of the trucks of the tender and baggage car. The crushing of the receptacle containing the liquid seems to have caused an explosion.

24th, on Cincinnati, Saginaw & Mackinaw, in Saginaw, Mich., a passenger train which was approaching the station was struck by an electric street car which approached a crossing at uncontrollable speed, and the cab of the locomotive was wrecked. Two persons on the street car were injured.

25th, on Chicago, St. Paul, Minneapolis & Omaha, near Bashaw, Wis., a passenger train ran into a logging train of the Shell Lake Lumber Co., which was crossing the railroad track contrary to rules. The engine of the passenger train was badly damaged.

25th, on Louisville & Nashville, near Hampton, Tenn., the fireman of a passenger train was badly scalded by the blowing out of a plug in the firebox. The engineer was injured by jumping.

27th, on Louisville & Nashville, near Hanceville, Ala., the engine of a passenger train was badly damaged by the breaking of a parallel rod, the engineer being injured. And 6 others on 4 roads, involving 5 passenger and 1 freight train.

A summary will be found on another page.

Air Brake Standards.

A meeting of the committee appointed by the Master Car Builders' Association to report at the next Annual Convention on a standard of efficiency to which all power brakes shall be subjected before they receive the indorsement of the Association was held at Chicago, March 25, all members being present. The following specification was prepared and is now submitted to brake manufacturers and others interested in safety appliances for criticism:

(1) Brakes will be tested on either a 50 34-ft. car train, or on a rack representing the piping of a 50 34-ft. car train. In the latter case special effort must be made to have all cocks, screens, angles and connections identical with those in train service. A drawing will be submitted showing what shall constitute the proper fittings, pipe, etc., for one car, including engine connections to the pilot.

(2) Pressure.—Tests will be made with a uniform train pipe pressure of 70 lbs.

(3) Piston Travel.—In testing brakes the piston travel must be so adjusted that it will not be less than 6 in. or more than 7.

(4) Construction of Triples.—Triples must be constructed so that they can be secured and operated on apparatus conforming to diagram fig. 1. (The committee will publish this diagram at a later date, or will furnish it immediately to any brake company requesting it.)

(5) Application Test No. 1.—Brakes must commence to apply on the fifteenth car in three seconds or less than three seconds from the moment of first application on the engine, and must indicate at least 55 lbs. in the cylinder in 3½ seconds or less from the initial application.

(6) Application Test No. 2.—Commencing with the fifth car from the engine, the air from the cylinders of three successive cars will be cut out. The brakes will then be applied as per test No. 5, and if they fail to make the time stipulated on the fifteenth car the brake will not be considered as coming within the Association's requirements.

(7) Release Test No. 1.—A uniform pressure of 70 lbs. having been secured in the train pipe, all the air will be exhausted from the train pipe. After a pause of 10 seconds to allow the equalization of the auxiliary and cylinder pressure, the train pipe will be pumped up to a pressure of 63 lbs., and the record of the condition of the brakes taken. All brakes that are found applied at this pressure will be considered as not releasing.

(8) Release Test No. 2.—This test will be arranged the same as in No. 7, except in the release. In place of pumping the pressure off, 90 lbs. will be accumulated in the main air reservoir and turned into the train pipe. After a period of six seconds, at which time all brakes should be released, the record will be taken as before.

(9) To insure the accuracy of the measurements of time in application and release electrical recording apparatus will be used.

The Committee adjourned to meet at the Grand Pacific Chicago, at 10 a. m., April 22, 1892, at which time representatives from the various brake companies and others interested will be invited to discuss the above tests.

(G. W. RHODES,
Committee: E. B. WALL,
GEORGE GIBBS.

Smoke Prevention in St. Louis—An Expert Opinion.

About a year ago a general committee was formed to consider the smoke problem in St. Louis and a special committee of experts was appointed to investigate the matter and report. This special committee, consisting of Col. E. D. Meier, Prof. W. B. Potter, Mr. R. E. McMath and Mr. C. E. Jones, have recently presented a report which is very complete and which covers all points of the smoke prevention problem. It includes an introductory treatise on the importance of the subject and the misapprehension which exists as to the nature of the problem; the principles and reactions upon which combustion depends, the conditions favorable for producing smoke and those required to prevent its production; the fuels used in St. Louis and their relation to the problem; the various class of fuel users and their relation to the smoke problem; conditions of fuel consumption under boilers in St. Louis; requirements necessary for a satisfactory smoke preventing device; classification of the important types of smoke preventing devices and the principles upon which they depend; the experience in other cities relating to the abatement of the smoke nuisance, and finally conclusions and recommendations. The report and appendix covers about 53 pages of typewritten legal cap and is well worth reprinting if space permitted. We present the following abstract of the most important parts:

After explaining the principles of combustion in furnaces and the effects of the presence of moisture and ash, the report continues: The term hydrocarbon is applied to the complicated series of organic compounds set free during decomposition. For present purposes these may be divided into three series, viz, the light hydrocarbon or marsh gas series (CH_4) with three parts of carbon by weight to one of hydrogen; the heavy hydrocarbon or olefant series (C_2H_6) with six parts of carbon to one of hydrogen; and the asphalt or bitumen series which is too complicated to receive any definite formula, but which contains still more carbon in proportion to hydrogen than in the olefant series and also more or less oxygen. The marsh gas and olefant series are gaseous forms of hydrocarbon, and the asphalt or bitumen the solid form which is more or less easily melted as the proportion of hydrogen is greater or less. . . . The heavy hydrocarbon is easily affected by heat and dissociation occurs at a red heat, resulting in half of the carbon being set free, leaving the gas as light hydrocarbon ($C_2H_4 = C + H_2$). It is this separated carbon in the incandescent state which in the main causes the luminosity of the flame when the heavy hydrocarbon is burned, and it is this same separated carbon which makes the visible smoke when bituminous coal is burned. For the rapid combustion of this separated carbon not only is a strong oxidizing action necessary, but a very high temperature as well, probably not less than 2,000 degrees F.

If the high temperature is not supplied in the fire-

place where the gases are generated and the carbon separated, the latter will be carried along by the rapid draft and pass out unchanged as visible smoke. . . . [Illustrative of the small proportion of coal actually represented by black smoke, reference is made to Mr. J. C. Hoadley's tests, by which it was shown that dense black smoke represented but about one-sixth of one per cent. of the weight of coal used. The reasons why the prevention of smoke is so difficult are then explained in detail.]

The approximate quantities of fuel used in St. Louis during 1891 are given as follows:

Illinois bituminous coal.....	2,142,126 tons.
Pittsburgh bituminous coal.....	56,000 "
Gashouse coke.....	36,000 "
Other coke (total received).....	165,000 "
Anthracite coal.....	60,000 "
Gas.....	50,000,000 cu. ft.
Oil.....	No figures.

The working seams of Illinois coal reach within about eight miles of the city. Its heating power is usually about 10,000 heat units by calorimeter test. The best Illinois coal has a heating power of about 12,000 heat units. [The ordinary uses and peculiarities of these various fuels are then described in detail.] Pittsburgh coke costs about \$5.25 per ton, while the price charged for gas house coke is \$5 per ton at the works.

Considering the smoke producers, the report discusses domestic fires, industrial furnaces, locomotives and boiler plants. For domestic uses, the prevention of smoke requires the use of smokeless fuels, such as anthracite coal, coke and gas, and it is shown that such fuels can be substituted for bituminous coal without greatly increased cost. Industrial furnaces, including metallurgical and similar work, are not serious smoke makers. Locomotives are said to be a prominent class of offenders and the use of coke is suggested as a remedy.

For boiler furnaces, which are the most important class, no assistance can be expected from the substitution of smokeless fuels. Illinois coal costs \$1.25 per ton, and the use of anthracite would double the cost of steam production. The uselessness of attempting to convert bituminous coal into gas and distribute it to boiler plants is then shown. The average quality of fuel gas made from a trial run of several car loads of Illinois coal, in a well designed fuel gas plant, showed a calorific value of 213,391 heat units per 1,000 ft. This is equivalent to 5,052.8 heat units per pound of coal, whereas by direct calorimeter test an average sample of the coal gave 11,726 heat units. One pound of the coal showed a theoretical evaporation of 11.56 lbs. water, while the gas from 1 lb. showed a theoretical evaporation of 5.23 lbs. Forty-eight and seventeen-hundredths pounds of coal were required to furnish 1,000 cu. ft. of the gas. Taking the efficiency of coal used direct as 50 per cent., and that of gas at 90 per cent., and the cost of coal at 6 cents per bushel, and gas at 8 cents per 1,000 cu. ft. (which is about the cost of manufacture and distribution upon a large scale), we have as the cost of evaporating 1,000 lbs. of water by coal direct = 13 cents, and the cost of converting this coal into gas and evaporating 1,000 lbs. of water = 35.2 cents. It is shown that Lima oil at present prices, and with an efficiency of 80 per cent. of the cost per 1,000 lbs. of water, would be 17.54 cents.

It is evident, therefore, that the only fuel likely to be used to any extent for boiler work in and about St. Louis is bituminous coal, and that of a quality highly conducive to the production of abundant smoke. In the vast majority of boiler plants in the city, the boilers are taxed, at least for an important part of the time, much beyond their capacity when considering the limited amount of coal required for a good smoke record. To supply the additional power, excessive amounts of coal must be burned, and under ordinary conditions dense clouds of smoke are sure to result. Also in manufacturing establishments the demands for power are very variable, and jumps of 100 per cent., within an hour in the demand for steam have been found by tests, varying from a little under the normal work of the boiler to 80 per cent., above it. It is frequently impracticable to meet these requirements by an increase in the boiler plant on account of the lack of space, and the heavy expenditures which would be necessary.

A circular letter to boiler users developed the fact that various kinds of smoke preventers had been used but have generally been abandoned. It was difficult to get satisfactory replies, as many steam users go on from year to year without even an approximate idea of the amount of work their boiler plants are doing. It appears that less than 45 out of 100 of the steam plants in St. Louis could make use of the general run of "smoke consumers" without risk of shutting down. [The report then takes up the requirements for a successful smoke preventing device.] Of the almost countless number of devices proposed many have decided merits and are capable of successful operation when the conditions are favorable. The severe test, and which few are able to pass, is that of capacity. With a fuel consumption up to 18 to 20 lbs. of coal per sq. ft. of grate per hour, the better devices are able to show a good smoke record, but fail when the consumption is pushed beyond these limits. The importance of this capacity will be appreciated when it is understood that in the majority of the boiler plants of the city these limits of fuel consumption are greatly exceeded during an important part. If not the whole time, of their operation. It is not uncommon to find boilers forced to the extent of 30 lbs. per sq. ft. of grate per hour. Finally, it may be stated without fear of successful contradiction, that not one of the devices so far brought forward is capable in its present form and application of fully meeting and satisfying all the requirements specified above.

Steam Jets.—These consist of steam injectors to force air into the fireplace either directly from the outside or after being heated. They have been applied in many ways and have been called by many names. The action is essentially the same in each whether the nozzles are placed in front above the fire doors, in the side walls of the fireplace, or in the bridge wall. It is to supply air in sufficient quantity above the fuel bed for the combustion of all combustible materials, and to effect such a thorough mingling of the air, gases and carbon that combustion will take place more readily, and hence not far beyond the fireplace. Where the heat is sufficient more or less water gas is formed by the decomposition of the steam into hydrogen and oxygen, the latter in a nascent state being more effective in oxidizing the separated carbon, and the former readily burning back to water by combination with the oxygen of the air blown in.

These jets can be made to work satisfactorily where the demand upon the boiler is comparatively light and does not vary much, but it is necessary to supplement their action with careful and regular firing. If too much coal is charged in the fireplace at a time, the tempera-

ture is likely to be so much reduced that the action of the jets tends to retard rather than to promote combustion, with variation in the demands upon the boiler, the jets require corresponding adjustment to secure favorable results. Such a system is, therefore, largely dependent for its successful operation upon the skill and faithfulness of the fireman. In most instances the capacity of the jet blowers is too small for the amount of work the boilers are called upon to do and where the capacity is sufficient it often happens that, with the careless handling usually practiced, the amount of steam used in the jets more than offsets any gain in efficiency due to improved combustion. Another very important consideration is the setting and adjustment of the nozzles, which, if not very carefully attended to, may be the cause of a blow-pipe action upon the boiler shell or grate bars, resulting in a rapid burning of the metal, especially from the strong oxidizing action of the decomposing steam. Several instances of this kind have occurred in this city.

It will be evident, therefore, that the steam jet blower system, as usually applied and operated, is far from satisfying the requirements specified for a successful device. The determination of capacity and the adjustment in setting cannot safely be left to the boiler maker or boiler setter, nor to the engineer of the establishment, who is frequently only an engine tender. Nor can the operating of the device be left to the average fireman. On the other hand, it may be said that the requisite engineering skill and experience can always be obtained, if sought for, to secure a safe and suitable application of the system.

The necessary qualities to make a reliable fireman can also be had if those interested would appreciate the importance and advantage of demanding these and of offering suitable compensation for faithful and efficient services. Under such conditions the steam jet system can undoubtedly be made to yield satisfactory results in controlling the smoke, especially where the boiler capacity is ample for the requirements and where the service is not too variable. These results can be attained without injury to plant, but not without some increase in the cost of operating.

Fire-brick Arches or Checker-work.—These have been applied in many ways, and the resulting devices are known by many names. They are usually placed near the rear end of the fireplace or over the bridge wall. Their action is of a two fold character: first, to cause a more thorough mingling of the smoke and, gases with air admitted above the fire bed, and, second, to increase the heat of this mixture. The conditions favoring complete combustion, not only of the gases, but of the more difficult combustible separated carbon at the same time are thus brought about.

The arch causes the smoke, gases and air to pass through a constricted passage close to the fuel, beds which should be kept in the glowing coke stage. The arch itself serves not only to reflect the heat from the fuel bed, but as a storage accumulator of heat which tends to regulate the heat and keep it up to a more uniformly high temperature. The checker-work is intended to produce the same result, but in a slightly different way by dividing the general volume of smoke and gases into a number of small currents and causing more intimate contact with the firebrick surfaces.

So far as disposing of the smoke is concerned these appliances can be made to produce good results with careful firing. Their capacity in this respect is, however, comparatively limited, being dependent upon the proportion of heating surfaces to the volume of gases and smoke to be heated, and also upon the proper attention of clear combustion, which supplies the heat to the storage surface, with the fresh coal firing which calls for the heat stored up. Another and more serious objection is their want of durability, and hence comparatively high cost due, not only to the actual repairs, but to the interference with regular operations as well. Devices of this character cannot, therefore, be regarded as affording a satisfactory solution of the smoke problem.

Hollow Walls for Preheating Air.—A number of patents have been taken out based upon this system, but they are all likely to fall short of satisfying the requirements specified. With careful firing in boilers performing moderate and uniform duty this system forms more complete combustion above the fuel bed by supplying heated air through a number of small holes in slits in the walls of the fireplace and the bridge. It need scarcely be pointed out, however, that the capacity must be too limited to make its application to our boiler service of any material advantage. Other and well founded objections are that slues in the walls of a boiler setting are likely to make the construction less stable and durable. The openings also for the admission of air to the fireplace readily becomes clogged and suffer from the ignorance and unfaithful labor frequently found in boiler service.

Coking Arches or Chambers.—This system is a favorite one with many inventors of smoke-preventing devices. It consists in constructing a chamber in front of or an arch over the forward part of the fireplace where the fresh coal is charged and retained until the greater part of the volatile matter is drawn off. The resulting caking is then pushed to the rear to serve as the hot bed over which the volatile matter from the fresh coal in front is made to pass. These devices are intended to accomplish more fully what is aimed at in the system of firing in an ordinary fireplace, known as coke firing, which consists in firing in thin layers and small quantities at a time over the forward part of the grate and keeping the strong, clean heat of the glowing coke near the bridge wall.

For disposing of smoke these devices are effective only as far as the fireman is careful in working the fire and the amount of coal to be burned in a given time is limited. The use of arches, etc., in the fireplace is open to the objection that such constructions are necessarily short lived, exposed as they are to high heat, changing temperature and fluxing ashes.

Double Combustion.—Applications of this system have been attempted in many ways. Some have taken the form of duplicate fireplaces which are charged with fresh coal alternately. Suitable dampers or valves cause the smoke and gases from the freshly charged grate to pass beneath and thence through the other fire bed, which consists in the main of glowing coke. In other cases there is but a single fireplace, a portion of the smoke and gases being drawn by means of a fan blower from the breeching after having passed the boiler and forced under the grate to be passed through the fire bed a second time. It is clear that in passing such a large proportion of useless gases through a fire bed much of the air needed for combustion will be crowded out and heat will be absorbed in raising the temperature of these useless gases to that of the furnace. The double furnace requires extra room and the single furnace a fan blower, and both require more skill and attention than can be expected of the average fireman. Those applications of

this system which have been tried have generally proved short-lived.

Downward Draught Furnaces.—These have been applied in a variety of forms and under various patents for a number of years. They consist essentially of a fire place, with the back closed so that there is no direct communication for the smoke and gases to pass away under the boiler except downward through the fire bed. The closed back is formed either by a water leg from the boiler, which passes below the level of the grate, or a drum set below the level of the grate and connected at either end with the boiler by tubes, the space between the drum and the bottom of the boiler shell being bricked in solid. Owing to the intense heat upon the grate, it is necessary to substitute a water-tube grate for the ordinary bars, and these water tubes are connected at the back with the water leg or drum, at the front with the boiler shell by means of headers and connecting tubes. All these parts, therefore, belong to the water-circulating system of the boiler and supply so much additional heating surface.

By such a device the combustion of fuel is effected in a much more rational way than on the ordinary grate. The fresh coal is as usual charged on the top of the bed, but the air enters from the top and therefore cooler part, quickly gaining heat from contact with the heated coal, and passes with the smoke and distilling volatile matter through the bed of incandescent coke below. The separated carbon and all gaseous products thus become intensely heated. The moisture of the coal and the combined water of the volatile matter are decomposed into hydrogen and carbon monoxide, which, with the aid of additional air supplied below the grate, burn with useful effect, while the separated carbon disappears into invisible carbon dioxide gas.

In order to get the requisite amount of opening for draught, the water tubes forming the grate must be spaced at greater distance apart than is the case with ordinary grate bars. Some of the fuel will, therefore, drop through impelled by the force of the draught added to that of gravity. With caking coals such as most of our Illinois coals, the loss from this source is not great under moderate firing; when, however, the fires are pushed and frequently worked with a bar to loosen the mass of coke or to clean the grate, considerable coke falls through. This has led to the adoption of an auxiliary grate of ordinary type, set some distance below, and through this all the air is delivered for the combustion of the gases issuing below the upper grate. As the lower grate receives only the incandescent fuel falling from above the space between the two grates, it is in a favorable condition for completing the combustion, being highly heated and supplied with heated air.

Such a system is well adapted to insure a good smoke record even when the fire is forced, and to a large extent with careless firing. It has the advantage, also, of being readily attached to a variety of boilers and such attachment serves to increase the heating surface and hence the capacity of the boiler.

The objections to this type of smoke preventing device in any form in which it has been presented, arise mainly from defects in construction which, although more or less serious, can be overcome. The arrangement for admitting air for the lower grate through the floor plates in front of the boiler is defective in that it does not permit of control of the air current. Excessive quantities of air enter, causing unnecessary waste of heat and a lowering of efficiency.

The water tubes of the grate and the connecting pipes are liable to unusual strains at the joints and these latter are not altogether reliable. The water leg or drum, which acts as an inverted bridge, is subjected to intense heat, as are also the tubes of the water grate. Unless our St. Louis water is purified, scale will have a tendency to deposit at such places, especially on the lower surface of the water leg or drum whenever there is any imperfect circulation. Any marked deposit of scale on these surfaces would cause the metal to run rapidly and give way. While serious difficulties have not resulted to any great extent from these defects, there is always more or less danger, especially where high pressures are carried, and these defects should be overcome before the system can receive unqualified approval.

In many boiler plants it would be difficult to apply this system owing to the lack of necessary space. A distance of 2 ft. would be required between boilers, or pairs of boilers, to permit of cleaning the water leg or drum. It is necessary also to have a greater depth of 18 to 24 in. Notwithstanding these various objections, the system has so many valuable features that it gives great promise for the future, and is well worth the attention and study required to secure the needed improvements.

Automatic Stokers.—There is a great variety of these devices, some of which are applied independently and others as auxiliaries to other types of smoke-preventing devices. The principle involved in their operation is to secure regular and uniform feeding of coal to the fireplace by mechanical action instead of the irregular and unreliable service of the ordinary fireman. The mechanical action may be applied in the form of screw or hopper feeders to fixed inclined grates or to movable inclined or step grates. Most of these require the coal to be sized to nut, pea or slack grades, and but few are capable of handling to advantage lump coal or "the run of the mine." The coal when properly sized is fed with great regularity, thus doing away with the periods of heavy smoke development and clear firing. The gas and smoke are therefore distilled from the coal uniformly and near the upper or forward part of the grate, changing the fuel to incandescent coke as it approaches the lower end of the grate.

While automatic stokers are capable of giving good results under favorable conditions, their limitations are such that they cannot be regarded as applicable to any important extent for the boiler service of St. Louis. They require that a coal be used which does not readily cake, and which does not clinker to any serious extent. The boiler must be of ample capacity also, so that no forcing is required, when, as is so generally the case here, a boiler is forced, the tendency of the coal to cake and clinker is greatly increased. The moving grate bars often fail to prevent caking and the clinker is liable to choke the bars and impede their action. To clean a fire by hand where an inclined or a step grate is used is a very laborious and tedious undertaking for the fireman and he is too apt to shirk it or perform it inefficiently. Another limitation lies in the fact that although automatic stokers are provided with devices for varying their speed they cannot act as promptly nor follow the variations in demand as closely as the fireman with shovel and slice bar. With our caking and hard clinkering coals and overworked boiler plants any system with such limitations is likely to prove worse than useless as a device to diminish smoke or economize fuel.

The fact must not be lost sight of that in using any form of smoke-preventing device greater care must be exercised in the examinations of the boiler and that

more frequent cleaning of the interior is required. The better the combustion and the higher and more concentrated the heat resulting from this the greater the danger of overheating and burning the portions of the boiler heating surface on which mud or scale may lodge. It is well known that mud or scale will more readily settle on those portions of the furnace sheets receiving the most direct action of the flame, since rising currents will always be established, these inducing return currents from other portions of the boiler, which sweep scale and mud and all suspended impurities to these points. In those devices in which danger points are covered or obscured from the eye of the fireman or engineer, the danger is of course increased. Boilers of inferior design, in construction, or defective to any extent in circulating action, will be rendered less secure by the application of any such devices as promote more efficient combustion. Your committee therefore inclines to the belief that before a general adoption of these devices the use of a simple but effective system of purifying the feed water before it enters the boiler will be necessary.

The report concludes with the recommendation of an ordinance declaring the emission of dense visible smoke to be a nuisance, and providing for its suppression within 180 days after the enactment of the ordinance. Also for the appointment of smoke inspectors and the creation of a commission of three competent persons who shall not be directly or indirectly interested in the manufacture, sale or construction of any furnace or other article having practical relation to the production or prevention of smoke. This commission is to test any devices for smoke prevention, under certain conditions; determine the applicability of smokeless fuels for various uses, and decide the conditions and liabilities under which manufacturing and other parties cannot wholly or reasonably prevent the occasional production and emission of dense smoke.

In the appendix it is stated that in 39 carefully conducted tests the smoke preventing furnaces showed only 74 per cent. of the capacity of the common furnaces, reduced the work of the boilers 28 per cent., and required about 2 per cent. more fuel to do the same work. In another case with steam jets the fuel consumption was increased 12 per cent. for the same work.

The Cyclone Ventilator.

The ventilator shown by the two illustrations has recently been brought out by Mr. M. C. Hammett, of Troy, N. Y., the maker of the Richardson and Allen-Richardson balanced slide valves. It is made from the designs of Mr. W. S. Rogers, superintendent for Mr. Hammett. These ventilators are of a new type and consist of a fan driven by a windmill not unlike those used for an anemometer. The mill has radiating arms, the extremities of which are hollow semi-spherical blades.

The ventilators are placed on the outside of a passenger car deck in the same manner as the ordinary type. On coaches having movable deck sash and wire screen guards they are placed on the outside of the guards. Four of these ventilators are considered sufficient to thoroughly ventilate a car. The movement of the fan draws out the impure air. They are driven by the motion of the car through the atmosphere or by the wind passing over the car.

Smoking car No. 3 on the Delaware & Hudson Canal Company's road is equipped with ten of these ventilators in place of 26 of the ordinary type. The car is much better ventilated with the Cyclone and requires no attention on the part of the trainmen to keep the ventilation comparatively uniform when the car is running or whenever there is a slight wind. A considerable number of these ventilators are now being put in service.

Improvements on English Railroads.

THE SOUTHEASTERN.

In the last two or three years the Southeastern Railway has shown a laudable anxiety to bring its passenger rolling stock up to a higher standard of comfort and convenience. Its last step in this direction has been, as we briefly recorded yesterday, the importation from America of an entire train of what in this country are always known as Pullman cars, though, in fact, in this case the cars have been built by a rival firm of older reputation than the gigantic Pullman Company—viz., the Gilbert Car Manufacturing Company. The cars, which are six in number, consisting of five drawing room cars and one buffet car, were on Wednesday [March 2] run on a special train down to Hastings and back. [The writer here describes the Gilbert cars sent to England, which our readers are measurably familiar with.—EDITOR.]

Though run together on Wednesday as a train, these cars have not been fitted with vestibules connecting the one with the other, in accordance with modern American practice. For it is not proposed to keep them together in daily working, but, on the contrary, to divide them over the principal expresses running to Dover, to

Folkestone, and to Hastings, in which they will be available, it is understood, to first-class passengers without extra charge. So far, so good. And, for the liberality which makes these carriages available gratis, instead of exacting, as on the Brighton and Southwestern lines, an extra fare, the Southeastern is certainly entitled to credit.

It may be questioned, however, whether by this or any other means the Southeastern will be able to prevent the steady gravitation of what the chairman terms "respectable" people from the first class into the third. Surprise is often expressed at the popularity of the Pullman in its own country and its comparative failure here. The reason, however, is not far to seek. From New York, for instance, to New Haven (73 miles) the fare is 8s. in the ordinary cars—or, in English railroad phrase, third class—and 10s. Pullman. To Philadelphia (90 miles) the fares are 10s. and 12s. respectively. Naturally, in America everybody who is even moderately well off pays the small extra fare for the large additional comfort. But with us the fares to Dover are 6s. 2½d. third and 20s. first; to Hastings 14s. first class and 5s. 0½d. third. Equally naturally, therefore, everybody to whom ten or twelve shillings are of some importance goes third. Whether it would pay the English railway companies to reduce their first-class fares to something like 20 or 25 per cent. over their third-class fares, this is not the place to discuss. But the fact is clear to any one watching the matter from outside that, till they do so they cannot hope, by adding to the attraction of first-class travel, to increase the present percentage of first class to the total. Whether, indeed, they can even arrest the steadily progressive decline is more than doubtful. And, meanwhile, the large cost, alike for construction, for maintenance, and for haulage, of drawing-rooms such as the new Southeastern cars is not doubtful at all.

Of more importance to the general public than any increase in merely first-class accommodation is another Southeastern improvement, which commenced on Tuesday last. The *Times* chronicled a week back the opening of a new line from Strood across the Medway into the heart of Chatham. In connection with this extension a new and very creditable service of expresses has been put on. There are seven trains down and six up, which accomplish the journey between London Bridge and Strood, a distance of 29½ miles, in just over three-quarters of an hour, an average speed, that is to say, of 38 to 39 miles an hour.

GREAT WESTERN.

Last week we had occasion to chronicle the improvement in first-class carriages introduced by the Southeastern Railway for the benefit of the few passengers—in the Southeastern case it is 3½ per cent. of the whole—who still use that class. To-day we have to notice an innovation made by the Great Western Railway, which affects the comfort of passengers of all classes, in the shape of what the company itself describes as a "corridor train." Yesterday (March 7) this train was put into service for the first time, and ran as the ordinary 1:30 p. m. express from Paddington to Birkenhead.

The Great Western has joined the carriages together with a covered gangway of the fashion commonly used to connect together post-office sorting vans, along which, however, it is not proposed to allow passengers to pass under ordinary circumstances. . . . The train, which has a total length of 240 ft., is made up of a guard's van 40 ft. in length and four passenger carriages of 50 ft. each. Two of these are third class, one is second and one first; but the design of the carriage is the same in each case. At one end is a gentlemen's lavatory, next it is a smoking saloon, the size of two compartments, but seated, so to speak, as two ordinary compartments with a broad gangway cut through down the middle, thus affording quite a large number of comfortable corner seats. Beyond this come four compartments of the ordinary shape, except that they are narrowed by the width of the corridor cut off from them. The last of the four is reserved for ladies only, and beyond it comes the ladies' lavatory. The first class is, of course, upholstered in morocco and broadcloth, while the second and third have to be content with cheaper materials, but for practical purposes of comfort there is really not very much difference between the three. It may be added that each compartment has a door opening direct to the outside air on the one side, while opposite each there is an outside door in the corridor. There is thus none of that blocking of gangways and meeting of opposite currents of passengers which so often on the Continent makes the entrance to and exit from corridor carriages so difficult and tedious. In each compartment is an electric bell, by which, in case of need, the guard can be summoned. It is to be hoped that American passengers will not use it too often when their needs are nothing more pressing than a supply of candy or a glass of ice water.

But the electric bell is supplemented by a more potent weapon in case of real urgency. For, outside the carriage on either side—outside, be it noted, for the railway man cannot away with the belief that ordinary passengers are children unfit to be trusted with edged tools in their nurses' absence—along the cornice, where hitherto has run the communication cord—so called, it is understood, on the *lucus a non principio*—runs a wire, a pull at which opens a valve in the train-pipe, destroys the vacuum, applies the brake, and promptly brings the train to a standstill.

Like all modern Great Western rolling stock, the carriages are well lighted with compressed oil gas, and plenty of it. They are heated, moreover, with steam drawn direct from the engine. Now that both the Midland and the Great Western have taken up this matter of steam heating, we may surely trust that the days of tepid water tins are numbered.

One other point is not without interest. The earliest passenger "coaches," as is well known, had the ends of each compartment rounded and bulged out at the door to simulate the shape of an old mail coach body. With first-class carriages, at least, the custom still survives in France, though in England carriages of this shape have been practically extinct for a generation past. But in this, its last new train, the Great Western has revived the original shape, with the practical object of restoring to the middle of each compartment as much as possible of the width that the corridor has abstracted, and at the same time avoiding an increase of the width and the overhang above the wheels throughout the entire length of the carriage.

Such, then, is the type of train which the Great Western offers as the best attainable combination of English and American ideas. It may be fairly said to combine the privacy and separation of the compartment system, which English people undoubtedly value, with safety and freedom, which also have unquestioned advantages. How far the English public will take to the new system remains to be seen. . . . As long as the railway company is compelled to keep the gangways between the different carriages closed and locked, by a not un-

natural fear that otherwise third-class passengers will assume the privileges of first class without paying first-class fares, so long the full advantages of the "corridor" system will not be experienced.—*W. M. Acworth, in The Times (London).*

Annual Report of the Pennsylvania Relief Department.

The sixth annual report of the Voluntary Relief Department of the Pennsylvania Railroad and its controlled companies east of Pittsburgh and Erie has just been published. It is for the year ending Dec. 31, 1891. In brief, it shows a balance on hand at the beginning of the year of \$144,589, contributions and interest received, \$520,773; total, \$665,362. The benefits paid during the year were \$530,183, leaving a balance of \$135,179. The regulations of the department require the surplus to be paid into a superannuation fund every three years, and the action taken under this rule for the period ending three years ago has now accumulated a fund of \$211,413. Payments to this fund in 1891 have been considerable, leaving for last year's operation (after taking account of unsettled liabilities of \$49,219 and estimated liabilities of \$88,118) an estimated deficit of \$20,502. The fund of \$211,413 is drawing interest, but no decisive action has yet been taken as to the precise use that shall be made of it.

The total number of members is now 27,300, a net gain of 2,216 during the year. The death rate during the year was 14.3 per 1,000 members, and the average number of members constantly disabled was equal to 38.7 per 1,000. There were two general visitations of la grippe during the year, which considerably increased the death rate and the sick rate. There were epidemics of small pox at two places during the year, but no member had the disease. Over 2,000 members and other were vaccinated.

Revolutions per Mile and Centrifugal Force of Locomotive and Car Wheels.

The accompanying table gives data of the number of revolutions per mile and the centrifugal force of car and locomotive wheels and counterbalances. The figures in the table and the titles explain themselves.

Diameter of the wheels in inches.	Circumference of the wheels in feet.	Revolutions per mile.	Factor which if multiplied by speed in miles per hour gives revolutions per minute.	Factor which if multiplied by speed in miles per hour gives revolutions per second.	Factor which if multiplied by speed in miles per hour gives velocity in feet per second.	Factor which if multiplied by square of speed in miles per hour gives centrifugal force, in pounds, of 1 lb. at 1 ft. from centre.
26	6.81	775.3	12.92	2.153	1.354	.05994
28	7.33	720.3	12.00	.2000	1.237	.0491
30	7.85	672.6	11.31	.1868	1.173	.0474
32	8.4	631.1	10.18	.1696	1.097	.03536
34	9.42	590.5	9.34	.1556	.978	.02970
36	9.95	550.6	8.84	.1440	.926	.02653
38	11.52	489.	8.00	.1353	.856	.02181
40	12.57	450.	7.44	.1273	.800	.0187
42	13.09	403.4	6.72	.1120	.704	.01539
44	13.61	387.9	6.47	.1078	.677	.01432
46	14.14	373.4	6.22	.1033	.652	.01320
48	14.66	360.2	6.00	.1000	.629	.01229
50	15.18	347.8	5.79	.0965	.607	.01144
52	15.71	336.1	5.60	.0933	.587	.01070
54	16.23	325.3	5.42	.0903	.565	.01002
56	16.75	315.2	5.25	.0875	.550	.00939
58	17.28	305.5	5.09	.0848	.533	.00882
60	17.80	296.6	4.94	.0823	.518	.00833
62	18.33	288.1	4.79	.0798	.503	.00796
64	18.85	280.1	4.67	.0778	.489	.00743
66	19.42	268.6	4.31	.0718	.451	.00632
68	20.42	240.1	4.00	.0656	.419	.00545
70	20.95	224.1	3.73	.0622	.391	.00475
72	21.48	210.1	3.50	.0583	.367	.00418

TECHNICAL.

Manufacturing and Business.

The Louisville Contracting Co., with a capital stock \$10,000, has been incorporated at Louisville, Ky., for constructing bridges and new railroad work.

The Dickson Car Wheel Co., of Houston, Tex., has increased its capital stock from \$50,000 to \$75,000, for the purpose of enlarging its car wheel works.

The Jones Vestibule Sleeping Car Co., with a \$3,000,000 capital, has been incorporated at Denver, Colo., by ex-Senator Tabor, Col. A. C. Fisk and E. W. Sebben, of Denver.

Mr. William Lodge has withdrawn from the active management of the manufacturing department of the Lodge & Davis Machine Tool Co., at Cincinnati, and will hereafter build a line of machine tools on his individual account in the same city.

The directors of the new Pittsburgh Car Wheel Co., which will soon be prepared to manufacture car wheels in Pittsburgh, are P. H. Griffin, P. G. Smith, J. H. Fleming and R. J. Mercer, of Buffalo, N. Y., and C. L. Magee, of Pittsburgh. The new concern is a branch of the New York Car Wheel Works of Buffalo.

Iron and Steel.

The Llano Improvement & Furnace Co., of Llano, Tex., will shortly erect an iron furnace and steel plant in that place.

The Seaboard & Roanoke and the Atlantic and Danville will build a union station at Portsmouth, Va.

New Stations and Shops.

The new machine shop for the Henry R. Worthington Hydraulic Works at South Brooklyn, N. Y., will be built of iron, by the Berlin Iron Bridge Co., of East Berlin, Conn. The building is 200 feet long by 50 ft. wide with a 20-ton Sellen's traveling crane. The building is made from the designs of the Berlin Bridge Co., who furnish it complete, including the foundations and brick work.

A new station will be erected by the Northern Pacific at Yakima, Wash. This is to accommodate the residents of the old town, several miles from North Yakima.

The Great Northern is building a station at the intersection with the Bellingham Bay & British Columbia, in Washington.

Electric Snow Sweepers.

The work done by the Thomson-Houston electric snow sweepers, in Duluth and West Superior, clearing the street railroad tracks after the recent blizzard was remarkable. On the day of the storm, Wednesday, the sweeper was kept at work until the telephone and telegraph wires fouled the feed wires, tying up the entire line. In a few minutes the sweeper and all the cars on the line were snowed in and no attempt was made to clear the tracks until the following morning. The sweeper had been exposed to the storm from 2 p. m. on Wednesday until 10 a. m. on Thursday, and was clogged up with the snow which had nearly buried the car. The operator dusted the snow off the brush holders and rheostats and started up the sweeper without delay, and the only trouble experienced was the burning out of one fuse. There are 24½ miles of track in this system, and, save a small portion where there was solid ice, the entire line was cleared and in operation in 3½ days from the commencement of the storm. Much trouble was experienced with very heavy drifts that must be thrown from one track to the other, then from that track to the side of the street; so it will be seen that a considerable part of the work had to be done twice. Drifts up to 4 ft. in height were cleared, the practice being to make a 20-ft. rim shut off the propelling power and keep the flyer running at full speed. In this way about 6 ft. of the drift would be cut away at each attack. Drifts 3 ft. high and 20 ft. long were cleared without stopping. Drifts 8 ft. deep were shoveled out, leaving 2 ft. of snow in the bottom and this was thrown over the top of the side walls by the sweeper. Another difficulty encountered was side drifts which would force the front end of the sweeper from the track. Then again after the first day the snow was harder to handle, being packed by vehicles, also on account of moderation in the temperature.

In West Superior the experience was very similar. Work was abandoned at 5 p. m. on Wednesday and recommenced at 8 a. m. on Thursday and at 4 p. m. on the same day the cars were running on the entire line—12 miles—on schedule time. The land is far more level than in Duluth, and the drifts were not nearly so heavy or frequent. In each instance the sweeper was a standard Thomson-Houston, propelled by two waterproof single reduction motors, 50 type rated at 25 H. P. each. Each of the flyers was operated at a speed of 150 revolutions a minute by a No. 50 type high speed motor. Throughout the entire time, although the work was often considered beyond the capacity of the sweepers, there neither a single short circuit nor a grounding of any portion of the sweeper circuit.

The Busk Tunnel on the Colorado Midland.

The construction of the Busk-Ivanhoe tunnel through the mountains at Hagerman Pass, on the Colorado Midland, has proved a more expensive and difficult work than was anticipated when operations were begun about a year ago. All reports that the tunnel would not be completed are denied. One of the engineers states that there has been considerable trouble in prosecuting the work, particularly in the last month, but the main difficulties have been overcome and the engineers anticipate no more trouble. The difficulty was encountered at the Ivanhoe end of the tunnel. Although the geologists gave as their opinion that the mountain was of granite, a fault was reached, which was filled with soft material, making it necessary to timber. Even this was very difficult to do on account of the large flow of water, but everything will be made secure by solid masonry. The fault has now been crossed, and it is not expected that this difficulty will be met with again. The tunnel is being bored through the summit of the range and at an elevation of 10,800 ft. It is 9,400 ft. long, and the work has progressed a distance of 4,800 ft. It will take another year to finish the tunnel. About 200 men are being employed. The new tunnel is 800 ft. below the Hagerman tunnel and will reduce the grade from 3 per cent. to 1.40 per cent., and will shorten the line between Busk and Ivanhoe, Colo., 9 miles.

Air Brakes.

The following are extracts from circulars to which we have recently referred:

Lake Shore & Michigan Southern.—Inspectors will note carefully all cars fitted with air brakes and see whether they are equipped with the Westinghouse automatic brake or some other system. On all cars received, which have a different system of air brake from the Westinghouse, attach to the centre of the car door, or, if not a box or stock car, to the side sill of the car near

centre, on each side of the car, a white "odd brake" card, and at the same time cut out the air at the cut-out valve so that the car can be used in an air brake train without the brakes operating by air. Inspectors will report the initials and numbers of all such cars to the Division Master Car Builder at the end of each week. Division Master Car Builders will report weekly to this office the numbers and initials of the cars so reported to them.

Atchison, Topeka & Santa Fe.—The attention of conductors, yardmasters, and other trainmen is directed to the fact that these brakes cannot be used with safety in connection with the Westinghouse brake, and must therefore be cut out before leaving terminal or other stations where cars so equipped are taken into trains, making use of them as piped cars.

Coupler Standards.

The M. C. B. Committee on Coupler Standards met last Tuesday at Buffalo, and, after deciding to propose specifications for tests of drawbars, adjourned to meet at Pittsburgh April 26. All coupler companies and those interested are invited to attend.

Mr. von Borries on Compound Locomotives.

In a recent article in the *Organ für die Fortschritte des Eisenbahnwesens* Mr. von Borries states that the number of compound locomotives in use or being built increased during the year ending Nov. 1, 1891, from 1,034 to 1,358. In Russia alone the number has increased from 32 to 155. He believes that compounds will ultimately be adopted for all ordinary traffic, and that their adoption is only a matter of some experiment and the overcoming of personal prejudice. A brief account is given of trials of high speed two-cylinder compound locomotives, built about a year ago. These engines weigh about 50 tons; the cylinders are 17.7 and 25.6 in. in diameter by 23.6 in. stroke. The driving wheels are 71.2 in. in diameter; the grate surface is 21.5 sq. ft., and the heating surface is 1,206 sq. ft. In one test one of these engines hauled a train of 14 cars (37 axles), weighing about 242 tons, a distance of 67 miles in 92 minutes, which, allowing four minutes for stops, gives an average speed of 46 miles per hour. The tractive horse power, as calculated by the formula for train resistance $\left(2.4 + \frac{V^2}{100}\right)$, is 715. The vacuum in the smokebox was from 3.9 to 4.7 in. of water. In another trial a distance of about 40 miles was run in 54 minutes, with a train of 12 cars (34 axles) weighing 230 tons. With the same allowances as before, this is equivalent to about 48 miles per hour and 640 horse power. These are said to be the best results obtained in Europe to date.

Special Lectures at the University of Illinois.

Mr. D. L. Barnes, of the *Railroad Gazette*, gave a lecture on "Modern Locomotive Construction" before the students of the Engineering College of the University of Illinois at Champaign, Ill., March 24. The lecture was illustrated by lantern slides. This is one of a series of lectures by specialists in various branches of the engineering profession.

The Simplon Tunnel.

The final studies in connection with the tunneling of the Simplon have been made, and it is now possible to form some intelligent estimate of the importance and extent of this undertaking which will, it is thought, require at least nine years for completion. From particulars given in the *Moniteur Industriel*, it appears that the tunnel will be about 19,731 metres (12½ miles) long, exceeding considerably the length of the Gotthard tunnel, which is 14,900 metres or about 9½ miles. The tunnel will consist of practically two distinct sections of about equal lengths, the north section, 9,900 metres long, which will begin near Brigue, and the south section, about 9,800 metres long, which will terminate within a short distance from the station Isella. As of special interest, it is mentioned that over part of the south section there will be in reality two tunnels, each accommodating a single line of tracks, while the remaining length will be in the shape of a single tunnel with double tracks.

The power required in building the tunnel, for tunneling proper, ventilation, transportation of material, etc., will be supplied by two large hydraulic plants, one at each tunnel end. At the north end the water will be taken from the Massa, an appreciable head being attainable, promising, it is thought, a total of 2,950 H. P. At the south end something like 4,230 H. P. is counted on, the water to be taken from the River Cairasca. The total cost of the tunnel and accessories has been figured up to fall not far short of 80,000,000 francs, or about \$16,000,000.

Raising Illinois Central Tracks in Chicago.

The grade crossing problem in Chicago has at last been definitely taken up at one point, though it is not in the thickly settled part of the city, but opposite the World's Fair grounds. The Illinois Central, whose line runs alongside those grounds from Fifty-sixth to Sixty-seventh street, has decided to raise its tracks from Forty-seventh to Sixty-seventh, and at special meeting of the Chicago City Council on March 24 an ordinance was introduced empowering the company to raise the roadbed to a height varying from 7½ to 9 ft., so as to give a 12 ft. clear head way over the cross streets. The cross streets will have to be depressed from 2½ to 4 ft. This ordinance has re-

ceived the sanction of the Illinois Central Railway Company and the World's Fair directors, and if found satisfactory to the City Council it will undoubtedly be passed. The ordinance provides that the new roadbed shall be constructed upon a solid embankment except at street intersections, and wide enough for 10 tracks. The work is to conform to the plans of the Chief Engineer of the city and be done under the supervision of the Commissioner of Public Works. The road is to be carried over the street by steel or iron girders, and posts on the curb line will be permitted to decrease the length of the span. The work is to be completed by May 1, 1893. The entire expense is to be borne by the railroad company.

Reducing Smoke from Locomotives in Chicago.

The Chicago Society for the Prevention of Smoke has issued letters to the President and Superintendent of motive power of every railroad entering Chicago, stating that tests for smoke consumption have been made and three devices found that can be applied to locomotives, and will suppress the smoke nuisance; that the society does not wish to make complaint against any one, realizing that the roads ought to have time to do something; that 60 days will be allowed the railroads to equip their locomotives with any one of the three devices, or any other device that will do away with smoke; that at the end of that time there will be no more talk or discussion, but every offender will be prosecuted as fast as the officers of the Society can attend to the business. What the three devices are has not been explained.

Tie Plates.

The statement was made by Mr. Reece in his article on Tie Plates published in the *Railroad Gazette* of Feb. 19, that the movement over the curves just south of the Louisville Bridge exceeded 1,000 cars a day. The word cars should have been omitted, as there are over 1,000 independent movements, from light engines to full trains.

THE SCRAP HEAP.**Notes.**

The railroads of Mexico have taken united action looking to the adoption of a national standard of time.

A dispatch from the city of Mexico last week stated that six men, caught by police loosening rails on the Mexican Central, were immediately shot.

The railroads throughout a large territory in Georgia and Alabama were much damaged by heavy rains the latter part of last week. The Central of Georgia suffered by washouts at many places.

The New York Central will hereafter have all its flagmen at crossings in the cities along the line uniformed. The uniform will consist of a blue cap and blouse and gray corduroy trousers.—*Buffalo Courier*.

A bill has been introduced in the Iowa Legislature making it unlawful to employ any man as a locomotive engineer who has not previously served three years as a locomotive fireman; and no engineer must be employed on a passenger train who has not had at least one year's experience in running from station to station.

The House Committee on Patents held a hearing at Washington on Saturday last, at which the claim of William K. Tubman, of Baltimore, that the Eastern Railroad Association had persecuted him and was an unlawful organization, was heard. President W. D. Bishop, of the Association, denied all the charges brought against it, and the reports state that the committee decided to take no action on the petition of Mr. Tubman.

Mr. L. S. Coffin, representing the Brotherhood of Railroad Trainmen, appeared at Washington last week before the Senate Committee on the Columbian Exposition to plead for observance of the Sabbath in order that the railroad employees might have an opportunity for rest. Incidentally Mr. Coffin stated that his constituents intended to request Congress to pass a law prohibiting the running of interstate mail trains on Sunday.

A decree was filed in the United States Court in Charleston, S. C., last Saturday directing the railroads in the state to pay into court the amount of taxes based on the old assessments, and directing the Clerk of the Court to turn the money over to the state. The suit grew out of an attempt on the part of the state authorities to raise the railroad assessments, which was resisted. The railroads made a tender of the taxes based on the old assessments, but the state refused to receive the money. Subsequently the state applied to the courts to be allowed to receive it. All of the roads have taken out injunctions restraining the state from levying on their property. The matter will be heard in April.

Canadian Coal Statistics.

During the fiscal year ending June 30, 1891, Canada imported 1,598,855 tons of bituminous and 1,399,067 tons of anthracite coal. Of this quantity only 36,002 tons of bituminous coal came from Great Britain. The distribution of this imported coal was as follows: To Ontario, 1,510,411 tons; to Quebec, 72,880 tons; to New Brunswick, 4,491 tons; to Manitoba, 9,788 tons; to Nova Scotia, 28 tons, and to British Columbia and North-West Territories, 1,257 tons. In the same year Canada exported 833,684 tons of bituminous coal, of which Nova Scotia furnished 173,105 tons; Quebec, 10,262 tons, and British Columbia, 617,508 tons. The North-West Territories also shipped 2,232 tons. Of this product 25,940 tons went to Great Britain, 3,397 tons to Newfoundland, 12,296 tons to the Sandwich Islands and 682,705 tons to the Pacific coast of the United States, the latter being the output of British Columbian mines.



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EDITORIAL ANNOUNCEMENTS.

Contributions.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.

Advertisements.—We wish it distinctly understood that we will entertain no proposition to publish anything in his journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.

The strike of freight conductors and brakemen on the Canadian Pacific was ended last week by the agreement of the company to submit the questions at issue to five locomotive runners, one of whom is the chief of the Winnipeg division of the Brotherhood of Locomotive Engineers. It appears that the engineers offered their good offices and that the strikers accepted the proposition as promptly as the company did. This is the report from Winnipeg. Vice-President Shaughnessy was reported from Montreal as saying that the company had not bound itself to accept the decision of the arbitrators, but he told a reporter the next day that the story was false. He added that the enginemen simply proposed outside arbitration, whereupon he (the Vice-President) replied that they (the enginemen) would be acceptable as arbitrators. The main question, he said, was about payment for overtime. This result would seem to indicate either that the enginemen up that way are gifted with exceptionally judicial minds or that the company had got ready to settle on the trainmen's terms. The most prejudiced engineman in the world could, however, probably be depended upon not to give the brakemen any more favorable rates for overtime, as compared with the trip-rates, than he himself received; and there is really no reason of any consequence, except the fighting power of the engineers' brotherhood, why brakemen should not be allowed as much, in proportion, as engineers. When enginemen and firemen receive extra pay and the other trainmen do not, there are, it is true, only two men with an incentive to waste time, as against five or six if all were treated alike; but of course the only equitable way to adjust this matter is to watch the movement of trains so closely that unreasonable delays, caused for the purpose of increasing the payrolls, will be promptly detected and the men responsible for them punished. The victory of the Canadian Pacific brakemen, which, if we may trust the published reports, was a somewhat easy one, must be regarded as affording decided evidence of the power of their brotherhood, for the road is so isolated and its freight traffic is so comparatively light that it must have required more courage on the part of the men to begin the strike than on the part of the company to fight it.

The contract for making and erecting the block signaling apparatus for the New York Central & Hudson River Railroad from Albany to Buffalo has been awarded to the Union Switch & Signal Company. The same company had already taken the contract for signaling from Poughkeepsie to Albany. The new contract covers about 300 miles, and the earlier one 60 miles. As the 300 miles is equal to 600 miles of double track road, it will be seen that this will be probably the largest installation of signaling ever undertaken at one time, though the amount of work to be done by the Signal company is perhaps not so large in money value

as would be the case in a smaller installation of automatic signals; such, for instance, as that on the Chicago & Northwestern at Chicago. The Central does a good deal of the plainer work itself. The cost of a simple manual block signal system lies chiefly in the running expenses, but in this case new buildings (towers) will be erected for every block, and the Sykes locking apparatus is to be applied to all the signals; this will bring the first cost up to a large figure. Where the freight tracks are close to the passenger tracks, which is the case for most of the way, the semaphores are to be placed on bridges spanning the four tracks, thus making the expense considerably greater than it is in the plan heretofore generally adopted in four-track signaling; and, moreover, it is intended, we understand, to place the tower on this same bridge, in most cases. The bridges and towers are to be erected by the railroad company. The question whether or not to have distant signals seems to be yet unsettled, though the scheme to have, near the division termini, much shorter block sections, to be protected by automatic signals, appears not to have been given up. The Sykes locking will have the automatic attachment operated by means of a small piece of track circuit at the end of each block. By the operation of the track circuit magnet each signal goes to danger by gravity as a train passes it, and cannot be again pulled to "all clear" until the engine has passed some distance beyond the second station, or out of the block. The means by which this control over the signals is effected by the short sections of track circuit was described in the *Railroad Gazette* of Oct. 3, 1890. The block sections will average a little over three miles in length. The work between Poughkeepsie and Albany is already begun.

Coupler Legislation.

The reader who has had the opportunity and the curiosity to follow the statements made before the Senate and House Committees on Interstate Commerce, in the matter of automatic couplers and power brakes, will have been struck by the fact that the interest turns almost entirely on couplers. Hardly a word was said about brakes. He will also have been struck by the immense difference in experience, knowledge and wisdom of those who appeared before the committees, and by the broad differences in opinions and in statements of facts. Last week we referred briefly to this latter phase of the hearings.

There was nothing in the way of new evidence to show that there is need of legislation at all, or of haste in legislation. The familiar fact was presented that a great many casualties happen in coupling cars. Mr. Crocker said that 47 per cent. of all the accidents to employes in Massachusetts are coupling accidents, and that these are 33 per cent. for the whole United States (Interstate Com. Com. Report to June 30, 1890). This condition is serious enough; and if the railroads were doing nothing to help it, or if legislation were reasonably certain to help it, there would be little opposition to legislation, among men of reason and humanity. But the fact that the railroads are doing a great deal was very strongly presented, as was the probability that legislation would do as much harm as good.

Even the common assertion that coupling accidents have increased since the M. C. B. coupler was mixed in with the link-and-pin was not sustained, but was considerably discredited. That is, there are more accidents, but more work is done and more men are employed, and no one gave figures to show that coupling accidents have increased out of proportion to the work done. Mr. Crocker, who certainly is a careful and conscientious student, and deeply interested in getting a moderate and useful law enacted, said that it is "merely a surmise" that coupling accidents are increasing relatively to work done, and because of this "mixture of couplers." He said, "In fact there are certain indications in my own state of Massachusetts which lead to the impression that it may be that the danger of coupling a link-and-pin to a Master Car Builders' type of coupler is so apparent and so great that the employé is on his guard and takes unusual precautions." It is quite possible that the danger of the transition period is exaggerated. Further, Mr. Greene quoted from the Statistician of the Interstate Commerce Commission the very significant remark that "no statement has yet been gathered of the proportion of casualties that might have been avoided if all cars were supplied with train brakes or automatic couplers," and warned the committee that there are no figures to show how many of the coupler accidents are the fault of the form of coupler. The suggestion is good. There can be no doubt that a really automatic coupler would save many of these casualties to persons, but before the extreme measure of making a law to compel its use is

resorted to it would be just and wise to try to find out the number pretty accurately.

The activity with which the railroads actually are proceeding in applying the M. C. B. coupler was repeatedly brought out in the hearings. Mr. Ely said that the present output of about a dozen makers of the M. C. B. coupler is 30,000 a month—that is, 15,000 cars. "This," he says, "shows a remarkable and phenomenal progress." He estimated the total number of cars equipped with it at near 200,000, and that the Pennsylvania has 25 to 30 per cent. of its cars equipped. This is the same as Col. Haines' estimate, and our own, of total cars equipped last November; but from November to February there should have been 20,000 to 30,000 more cars equipped. The estimate of 15,000 cars a month is the largest that we have seen. Our estimate last November was about 8,000. Now, assuming that 15,000 cars are being equipped with M. C. B. couplers every month, in six years all the freight cars of the United States would be so equipped if the rate were not increased. But we may safely assume that the rate will increase if it is not interfered with by legislation or the fear of legislation.

Nobody is more keenly alive to this matter than the railroads themselves, unless it may be the makers. Considerations of interest as well as of humanity are constantly pushing them. How active and keen the interest is nobody knows unless he is a careful reader of the technical journals or sees much of the higher mechanical officers of the railroads. Elaborate records have been kept, and are still kept, to ascertain the wear and breakage of couplers. These records are made not only to learn the cost of maintenance, but to learn the weak places in the coupler. Investigations as to the best material and best proportions of the coupler are constantly in progress. The subject of uniform standard tests of couplers is now under careful consideration. These records and investigations cover, not 50 or 100 or 1,000 couplers, and not two or three months, but hundreds of thousands of couplers and several years of time. In fact, "enlightened selfishness," acting with ample means and opportunity, has given the railroads an amount of knowledge concerning couplers that no government commission could accumulate, short years of investigation.

Considering the doubtful result of legislation and the undoubted activity and interest of the railroads in the matter, it seems as if the whole question might still be left to them. In fact, of those who appeared before the committees, the men who by weight of character, by the habit of carrying serious responsibilities and by important public and private services are best entitled to be listened to were opposed on principle to legislation, but accepted it, if they did accept it, because of the apparent need of doing something. Mr. Ely, for instance, said: "I do not believe we should make a law merely because we do not know what else to do. The railroads have certainly shown great energy without law." Every bill that he has seen would be a leap in the dark and he has been unable to devise a bill that would be advantageous to the employes in the matter of safety. Mr. Rogers thought that there was "a fair opportunity for difference of opinion" as to the good of legislation, but that on the whole a very broad and liberal law would do more good than harm in stimulating the dilatory. Mr. Crocker's position is pretty nearly the same. He recognizes the value of the principle of non-interference, but thinks a moderate law will save lives and limbs. Col. H. S. Haines thought that legislation would "petrify the art of railroading," that about 20 per cent. of the freight cars are now equipped with M. C. B. couplers and that the railroads are solving the problem for themselves and will solve it with increasing speed if let alone.

As we said last week, the problem is one of extraordinary complexity involving social science and applied mechanics. Attempts to solve such problems by law are generally complete failures. The most absurd suggestion for the solution of this one, of all the suggestions that have been made, is that of a commission to choose a specific coupler; the most reasonable suggestion is to let the men who have already done so much finish the job as they began it, simply as a matter of business.

Standard Tests for Air Brakes.

The Committee on Air Brakes, appointed by the Executive Committee of the Master Car Builders' Association, has issued a report of its second meeting, giving a set of tests proposed to determine the value and efficiency of new forms of air brakes, and asking

those interested in the subject, including the manufacturers of brakes, to appear at the next meeting of the Committee April 22, Grand Pacific Hotel, Chicago, to discuss the proposed tests before a final report is made to the association. The members of the Committee are men of well-known ability and they individually have been instrumental in the selection of some of the most important standards of the Master Car Builders' Association.

A railroad company purchases air brakes for two purposes: First, as a safety appliance to stop trains quickly in case of emergency, and, second, as a device for controlling the speed of trains under service conditions.

Fortunately, the emergency feature can be and has been made, in a wholly pneumatic brake system, separate from that part of the mechanism which is used for controlling the speed under service conditions. We say "fortunately" because it would be quite impracticable to use a system in which the emergency application would be liable to occur when only a control of the train is desired. The separation of the emergency feature renders it possible to provide an additional and extra power to be used when it is necessary to make an extraordinarily quick stop.

Previous investigations of the Master Car Builders' Association have taught what makes a good brake, and the lines on which a pneumatic brake must be designed and developed are well laid down in the report of the Committee on Brake Tests, given in the Secretary's report of the Master Car Builders' Association for 1888, page 48. The conclusions in that report are for a 50-car train:

"First. It shall work with air of 70 lbs. pressure. A reduction of 8 lbs. shall set the brakes lightly, and a restoration of pressure shall release the brakes.

"Second. It shall work without shock on a train of 50 cars.

"Third. It shall stop a train of 50 empty freight cars when running at 20 miles per hour within 200 ft. on a level.

"Fourth. When tried on a train of 50 cars it shall maintain an even speed of 15 miles per hour down a grade of 53 ft. per mile without variation of more than five miles per hour above or below that speed at any time during the descent.

"Fifth. The brake shall be capable of being applied, released and graduated, on the whole train by the engine, or without any assistance from the brakeman or conductor.

"Sixth. The hose coupling shall couple with the present Westinghouse coupling."

These decisions were reached in 1888 after the most extended experiments with air brakes ever made, and to-day the same conclusions apply with even greater force. There is but little, perhaps, to add, except it might be said that in the second requirement it is understood that the train shall consist of cars equally or nearly equally loaded. In the third requirement it is to be understood that the brake shoes are to be in good condition, and the brake beam pressures about 70 per cent. of the total weight of the empty car.

To meet these requirements is no simple matter, and a set of tests that will prove that a new type of brake will fulfill these demands in actual service must necessarily be difficult to make owing to the varied conditions of service and by reason of the considerable number of parts and passages which make up a compressed air brake system.

The sizes of the cylinders, auxiliary reservoirs, levers, couplings, hose, strainers, stop cocks, and piping, have practically become standards already, and they are fixed or so nearly fixed that brake companies entering the field for business have generally accepted the prevailing dimensions of the Westinghouse air brake in these particulars as being the best for the purpose, so that the question to-day turns on the triple valve, understanding, of course, that the engineer's valve, the pump, and the engine equipment are properly arranged. So far as a brake system for freight service is concerned, we are more particularly interested in the apparatus that goes on the cars. A consideration of the parts that relate to the engine we may postpone for the moment. Other parts than the triple valve, however, require much attention, in order that a railroad company may get an equivalent in service for the money paid out for an air brake system. For instance, ordinary leather packing is not sufficiently good for an air brake cylinder, neither are ordinary castings at all practical for the cylinders and reservoirs. So, too, the piping, connections and valves must all be the best of their kind, or a large and unknown expense will be incurred in keeping up the parts.

The triple valve is affected by the first five of the six requirements above mentioned. To meet the first it is necessary that the triple valve piston, or diaphragm, or that part which admits air into the cylinders for service work and closes the passage into the

cylinders, and opens the exhaust for release, shall be so delicately made that an extremely slight reduction of pressure will actuate it. The 8 lbs. given is the reduction at the front of a 50-car train. The reduction at the rear is much less than this in effect. If 8 lbs. are taken from the front of the train the whole train will be reduced finally by that amount, but the reduction goes on so gradually at the rear that air will pass the mechanism of the brake and leak into the train pipe instead of forcing the diaphragm or piston to do the work of admitting air into the brake cylinder, unless the valves are very well made. Excellent workmanship for triple valves is also necessary to enable them to meet the fifth requirement. For the fourth, it is absolutely essential that the triple mechanism shall work freely, and in addition must close completely, when desired, the passage of the air from the reservoir to the cylinders. When descending a grade, and air is admitted to the cylinders to apply the brakes with a definite force, it is necessary that this force be not increased or decreased except at the will of the engineer. A continuous increase of the air pressure in the cylinders will delay the movement of trains down grades by causing too much retardation and make the speed irregular. A decrease in the pressure in the cylinders except at the will of the engineer, when running down a grade, is less troublesome, but should be prevented as much as possible, and to this end it is necessary that there shall be no leakage from the cylinder through the triple valve, and there must also be none past the leather packing of the cylinder piston.

To practically meet the second and third requirements, the triple valve must have an exceedingly quick action, but to meet those requirements exactly it would be necessary that the action be practically instantaneous, as was that of the electro-pneumatic brakes tested at Burlington in 1887. A triple, to meet the first and second requirements, must allow air to pass from the train-pipe to the brake cylinder in order to accomplish two ends: (a) the more rapid reduction of the pressure in the train pipe, and (b) an increase of force in the brake cylinder to make an additional power for emergency stops.

It has been shown that if a brake can be applied on the rear of a uniformly loaded 50-car train within two seconds after it is applied on the front of the train, the amount of shock will be inconsiderable and not enough to throw down live stock or cause injury to freight. It is not known how much greater time than this can be permitted without causing serious shock, but from recent tests, and the results at Burlington in 1887 and 1888, it is quite evident that three seconds is as much time as can be permitted if it is demanded that a brake "shall work without shock on a train of 50 cars."

It is argued by some that the avoidance of shock in freight trains is impossible, as the bunching of the train by the irregular action of the engine will frequently produce shocks of considerable amount, and therefore the total avoidance of shock, even in uniformly loaded trains, with instantaneous brakes, is impossible. Again, freight trains are not uniformly loaded as a rule, and if the heaviest part of the train is at the rear, or there be a lack of breaking power at the rear for some reasons external to the quick action part of the brake system, such as the use of hard brake shoes, etc., then the rear of the train may be expected to run into the front and cause shocks which an instantaneous action triple valve could not prevent. The argument then is that shocks cannot be avoided, and that a quick-acting brake system should only be demanded to act in such a way as not to give a shock greater than that obtained from the irregular action of the locomotive, and that resulting from mixed trains.

There is an illogical argument offered by some to show that a brake should not be required to act as quickly as is necessary to meet the second requirement. It is this: All cars are not fitted with brakes. When only the first 15 or 20 cars of a 50-car train are equipped with air, the cars in the rear, being without power brakes, will cause very severe shocks when an emergency stop is made, no matter how quickly the brake may act on the front, so that the large shock that will be found in service under these conditions, regardless of the quickness of the action of the brake, obviates any need for exceedingly quick action as a means of reducing shock. This argument is illogical because the time will soon come at the present rate of equipping freight cars, and before the present cars are worn out when 50-car trains in motion and equipped with air will be a common occurrence. Anyone watching freight trains moving in and out of Chicago will frequently see 40 cars running in a train all equipped with air and all air brakes "cut in" and in use.

The problem which the committee on air brake tests

has to solve is, what set of conditions can be established quickly and readily in some building or in an instruction car which will show what are the real merits of a proposed brake system when put in actual use? Such tests will generally resolve themselves into three kinds: graduation, release and emergency.

The requirement for graduation given in the Master Car Builders' report for 1888, page 48, before referred to here, is "a reduction of 8 lbs. shall set the brakes lightly." This means shall set the brakes lightly throughout the entire 50-car train, and is a sufficiently good test to determine the delicacy of the graduation of any brake when it is clean and in good condition.

The requirement for release given in the same reference is a sufficiently good test to determine the merits of the release feature of a triple valve, and this is fully covered by the test No. 7, proposed by the committee, which reads as follows: "A uniform pressure of 70 lbs. having been secured in the train pipe, all the air will be exhausted from the train pipe. After a pause of 10 seconds to allow the equalization of the auxiliary and cylinder pressure, the train pipe will be pumped up to a pressure of 63 lbs. and the record of the condition of the brakes taken. All brakes that are found applied at this pressure will be considered as not releasing." The 63 pounds mentioned is about 4 lbs. above the pressure to which the cylinder and reservoir equalize in emergency application. Possibly this proposed pressure should be changed to 70 lbs. with the same rate of increase as provided above, that is by pumping, as the test will then be quite sufficient to determine the merits of the release feature of a triple valve when clean and in good condition.

The test for emergency given in the Master Car Builders' report in 1888 above referred to, provides for a train in motion to be stopped without shock. Of course this is impossible in a shop test. It is, therefore, necessary to rely upon the measured rapidity of action. The proposed tests numbers 5 and 6 do not cover this point, as they do not represent the best known performance of air brakes in use. To lower the standard below the actual operation of the majority of brakes in common use is inadvisable and contrary to the general custom in selecting standards for the Master Car Builders' Association. Try as hard as we may we shall not get a brake system that is too good or too perfect, and therefore, within reasonable limits of cost, the best brake should be demanded and the standards of tests should be so high as to require inventors and manufacturers to supply a grade of brake mechanism that is at least as good in all respects as those now in use, and if possible should be such as to induce if not force the best makers of brakes to look closely to their designs and workmanship.

So far as we have approved of the proposed tests we have qualified the approval by the assumption that the brakes were "clean and in good condition." This qualification is necessary as it is a comparatively simple matter to design a triple valve that will work well when new, clean and well oiled. The great evil to be overcome does not exist until the brakes have seen service; it is grit. Freight brakes, particularly, are subject to a very severe test in service, as the couplings are not generally hung up, and they gather grit and dirt, which finally is blown into the triple valves in greater or less quantity and mixes with the oil and gum and causes the valves to "stick," and will in some designs interfere greatly with the action. So then as far as these proposed tests go they will do quite well enough, except, perhaps, those for the quick action numbers 5 and 6, to determine the theoretical action, of the parts when clean and in good condition, and such tests are necessary and essential, but not enough to base a conclusion on regarding the real merits when put into service. Something should be added to the description of the proposed tests to show that they represent ideal conditions, and if it is not possible to define the tests that will represent actual conditions, such as an endurance test or a test under conditions where grit is present, then a preliminary trial should be recommended in actual service as a supplement to the shop tests.

The Extension of the New York, New Haven & Hartford.

The acquisition of the New York, Providence & Boston by the New York, New Haven & Hartford, which, though under a temporary contract, is in all probability equivalent to a permanent union, is doubtless a good thing for both companies, and is significant as showing how irresistible is the tendency to consolidation of railroads whose interests demand unified control. Efforts toward this end have been made several times before, but they were unsuccessful for the usual reason, "incompatibility of temper"—as to the relative value of the respective stocks; and the conservatism

which supports such contentions was in this case unusually firm, not to say obstinate, on both sides. But it seems that the increasing influence of young blood in the counsels of the companies and the increasing danger of competition have finally overcome all obstacles.

The stock of the New Haven road is quoted at 228 and that of the other road at about 218. Both have received 10 per cent. dividends, and both properties are in splendid condition; but it is difficult for any outsider to judge as to the exact correctness of these stock-exchange estimates, for the reason that so many important improvements are yet to be made, especially by the New Haven road. It has acquired several branches, which may or may not have cost more than they are worth, and the line, all the way from the New York end to New London, is being improved to the extent of several millions of dollars. The single track Shore Line is being made double, and the double track from Port Chester to New Haven is being made four track. Over or under bridges for highways will probably require the expenditure of a million or more within the next few years. The New York, Providence & Boston's greatest burden is the Providence terminal.

But the idea of consolidation appealed as a necessity to both sides, in spite of any small differences about values. The New Haven road did not wish to see such a close neighbor fall into the hands of any other company, even so good a friend as the Old Colony. In a thickly settled country like Southern New England, it is a good rule in railroading to get all the territory you can; and the New Haven road can well afford to give share for share, especially as the additional stock which it must soon issue for its own improvements may reduce the value of its own shares.

On the other hand, the smaller road, though conscious of the advantage due to the presence of two suitors, one on either side, had to face the fact that it was practically at the mercy of its neighbors, so far as through business is concerned, and doubtless concluded that dallying would not forever be successful. The New York & New England, in spite of its erratic performances, might some day get a good grip on the New York-Boston passenger business. It already has a foothold which gives it some business between Boston and Providence, and a new line from Providence to New London would not be wholly out of the question.

The attitude of the Boston & Albany is one of the most interesting questions connected with this change, on account of its importance as a link in the oldest all-rail passenger line between New York and Boston, and its inability to do any passenger business between these cities except in connection with the New Haven road. The New Haven officers say that the Albany does not object to the bargain; but the New Haven certainly has a livelier interest in favoring the Shore Line, as against the Springfield line, than it had before, and it was lively enough before. The Shore Line division, now nearly all double-track, is not worked so nearly to its full capacity as is the Hartford division, and it is conceivable that important expenditures for additional tracks on the latter may be postponed considerably longer by turning the increase of travel over the New London route, than could otherwise be done. This consideration, together with a slight advantage in fares owing to the shorter distance, has favored the Shore Line heretofore, and now the profit on about 50 miles further carriage of each passenger is an added incentive to send passengers that way. The Boston & Albany's contract seems to be of the "most favored road" plan, for its accommodations and through time have always been equal, at least, to those of the other lines; but if its officers are wholly undisturbed at this move of the New Haven road, it must be that they regard consolidation of the latter with their own road as a practical, and perhaps a probable, remedy for any future disagreements. Indeed, there are no immediate business reasons for supposing that such a consolidation would not be as easy to arrange as was this one, though the Massachusetts people and legislature would doubtless insist on more publicity than Connecticut and Rhode Island ask for. Local pride, which is one of the prominent factors in perpetuating independence is not a business but a sentimental reason.

The effect of the consolidation on the fortunes of the New York & New England is more decidedly unfavorable, and a New Haven officer even avows an intention to make it so. The New England has been trying to work up an opposition "all rail" passenger route between Boston and New York, by way of Hawleyville, Oyster Bay and Brooklyn, though with indifferent success thus far. The way to stimulate business over a new line like this, somewhat slower than the older ones, is to reduce fares, of course; but this has not been done and there must be good reasons for the failure to do it. The New York & New Eng-

land now has two through trains to and from New York over the New Haven road, and it must be assumed that the profit on these is too large to be risked by taking any decidedly aggressive action tending to injure the New Haven road. Whether the latter is bound to continue those two trains, and to increase the number of trains or the rate of speed when it thus improves the Shore Line route, does not appear, but if it is not so bound the New England is of course hit as hard as the Boston & Albany, with the difference that in the case of the latter the New Haven people say that they did not mean to hurt.

The possession by the New Haven of a line from New York through to Worcester makes a fine paragraph for the news columns, but it has no great significance in reality, for the route is too roundabout. Passengers do not want to go that way and freight will mostly go by water to Providence in any event.

February Accidents.

Our record of train accidents in February, given in this number, includes 85 collisions, 115 derailments and 12 other accidents, a total of 212 accidents, in which 44 persons were killed and 103 injured. The detailed list, printed on another page, contains accounts only of the more important of these accidents. All which caused no deaths or injuries to persons are omitted, except where the circumstances of the accident as reported make it of special interest.

These accidents are classified as follows:

COLLISIONS:	Rear.	But- Crossing ting, and other.	Tot'l.
Trains breaking in two.....	11	1	12
Misplaced switch.....	3	2	5
Failure to give or observe signal.....	5	3	8
Mistake in giving or understand- ing orders.....	1	5	6
Miscellaneous.....	15	1	16
Unexplained.....	15	14	29
Total.....	50	23	73

DERAILMENTS:	Total.
Broken rail.....	9
Loose or spread rail.....	8
Defective switch.....	6
Defective frog.....	1
Broken wheel.....	3
Broken axle.....	3
Broken truck.....	1
Fallen brakebeam.....	5
Broken drawbar.....	5
Broken car.....	1
Boiler explosion.....	5
Misplaced switch.....	5
Runaway train.....	1
Unfastened switch.....	1
Failure in signaling.....	2
Too quick application of brakes.....	1
Bad loading.....	1
Animals on track.....	3
Landslide.....	2
Washout.....	1
Ice or snow.....	1
Malicious obstruction.....	3
Accidental obstruction.....	4
Unexplained.....	45
Total.....	115

OTHER ACCIDENTS:	Total.
Boiler explosions.....	2
Broken side rod.....	1
Cars burned while running.....	4
Various breakages of rolling stock.....	2
Other causes.....	3
Total.....	12

Total number of accidents.....	212
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A general classification shows:

	Col- lisions.	Derail- ments.	Other acc'd's.	Total.	P.c.
Defects of road.....	24	24	11	59	28
Defects of equipment.....	12	21	5	38	18
Negligence in operating.....	43	11	4	58	27
Unforeseen obstructions and maliciousness.....	1	14	3	18	9
Unexplained.....	30	45	75	150	71
Total.....	85	115	12	212	100

The number of trains involved is as follows:

	Col- lisions.	Derail- ments.	Other acc'd's.	Total.
Passenger.....	31	39	10	80
Freight and other.....	141	77	3	221
Total.....	172	115	13	300

The casualties may be divided as follows:

	Col- lisions.	Derail- ments.	Other accidents.	Total.
KILLED:				
Employees.....	17	18	2	37
Passengers.....	1	1	2	4
Others.....	3	1	2	6
Total.....	20	20	4	44
INJURED:				
Employees.....	31	18	6	55
Passengers.....	15	25	..	40
Others.....	4	4	..	8
Total.....	50	47	6	103

The casualties to passengers and employees, when divided according to classes of causes, appear as follows:

	Pass. killed.	Pass. injured.	Emp. killed.	Emp. injured.
Defects of road.....	..	18	6	6
Defects of equipment.....	..	2	8	12
Negligence in operating.....	1	16	20	32
Unforeseen obstructions and maliciousness.....	1	3	2	1
Unexplained.....	..	1	1	4
Total.....	2	40	37	55

Thirty accidents caused the death of one or more persons each, and 39 caused injury but not death, leaving 144 (68 per cent. of the whole) which caused no personal injury deemed worthy of record.

The comparison with February of the previous five years shows:

	1892.	1891.	1890.	1889.	1888.	1887.
Collisions.....	85	93	64	51	57	57
Derailments.....	115	93	55	61	104	67
Other accidents.....	12	10	9	5	15	8
Total.....	212	196	128	117	176	132
Employees killed.....	37	52	50	30	21	21
Others.....	7	9	3	3	7	34
Employees injured.....	55	161	111	30	99	51
Others.....	48	114	60	49	65	55
Passenger trains involved.....	79	85	44	39	70	54

Average per day:

Accidents.....	7.31	7.00	4.57	4.21	5.93	4.71
Killed.....	1.52	2.18	1.89	0.82	0.97	1.96
Injured.....	3.55	9.82	6.42	3.14	5.06	3.78

Average per accident:

Killed.....	0.208	0.311	0.414	0.195	0.132	0.417
Injured.....	0.489	1.403	1.406	0.732	0.953	0.803

The total number of passengers and employees killed this month, 39, and the total number of passengers and employees killed and injured, 134, are the smallest that we have recorded since April, 1890. Only two passengers are recorded as killed, one at Kirkwood, Mo., on the 20th, and one at Smithwick, S. Dak., on the 19th. These accidents illustrate some of the conditions which need to be considered when we are comparing the record of American railroads with that of the well equipped roads of England. The Smithwick derailment is reported as caused by cattle on the track, and that at Kirkwood seems to have been due to pure carelessness of a gross kind. The dangers and annoyance due to the lack of fences constitute one of the most constant irritants to disturb the peace of mind of a superintendent in our Western states, and yet whenever he thinks of the excellent record of the English roads, in their thickly settled country, and aspires to match it, he is compelled to remember that Americans desire to travel just as fast, through our long stretches of farming country, as they would if their patronage were large enough to warrant the thorough fencing of every rod of the line, and watching every crossing. The Kirkwood collision would doubtless have been prevented by the use of the block system, even in the imperfect form in which it is used on some of our poorer roads; but in comparing records with roads able to provide all requisite safeguards, it is fair to remember that the adoption of even this imperfect form often requires such radical changes in the arrangement of side tracks and station arrangements that the expenditures constitute a large item. Managers are not justified in being so completely staggered by the expense as they often are, but it is easy to see that they must in many cases make the necessary improvements gradually.

At Lima, O., on Feb. 2, a passenger train of the Chicago & Erie ran at high speed through the yard and over a grade crossing a considerable distance beyond its stopping point on account of the engineer having been knocked insensible by a board projecting from a freight car on a side track. The reports say that the conductor stopped the train by opening the air valve in a passenger car before the fireman had discovered that anything was wrong. On the 29th, near Dobb's Ferry, N. Y., a man at work on a scaffold at a new signal tower was caught by the "catch-arm" on a mail car which was turned out by the mail agent to catch a mail bag a few feet from the tower. The man was very badly injured.

A street car was struck by a train of the Pittsburgh, Fort Wayne & Chicago, in Chicago, Feb. 10, injuring half a dozen passengers; and in Newark, N. J., on the night of the 17th, the driver of a horse car drove through the closed gates at a crossing and was struck by a Delaware, Lackawanna & Western train, the collision resulting in the death of the driver and the injury of seven other persons. Two or three passengers were similarly injured in Pittsburgh on the 2d. At Bonham, Tex., on the 20th, a "dummy" car was derailed and wrecked, injuring half a dozen persons.

The Ohio Legislature has revised the law of that state, (sections 3,340 and 3,341), concerning switching charges, and its provisions as they now stand are substantially as follows: Connecting roads must promptly transfer bulk freight, and cars for bulk freight, to or from stations, private sidings, etc., for each other, without demurrage for 48 hours. The charge must be at the regular rates per mile for the distance named in the tariff, corresponding most nearly to the actual distance, but never more than \$1 a car for one half mile or less, \$1.50 for distances from 1/2 to 2 1/4 miles, \$2 for 2 1/4 to 5 miles, and \$3 where over 5 miles. Where switching service is participated in by two or more companies they may charge at least \$1 each. There must be no charge for returning empty cars. Where switching is required by law to be done at night, 25 per cent. additional may be charged.

A German railroad engineer, taking for his text the paper by Mr. Petri, engineer attaché of the German Embassy at Washington, which set forth the great economy attained by increasing train loads in this country, discusses the policy which should be followed on the Prussian State railroads, and comes to the conclusion that they should increase the speed instead of the load of freight trains from the present standard of about 14 miles per hour to 28 miles per hour. He calculates the expenses per car mile at the higher speed one-fourth less for repairs, and only one-fifth more for fuel than at the present speed, and shows an enormous saving in wages and interest, though he allows three-fourths more cars per train at the low speed.

The reduction of French passenger fares and express rates described in the *Railroad Gazette* of Jan. 1 goes into effect April 1. The fares in cents per mile, as then stated, are changed as follows:

	Single tickets.			Round trip.		
	1st class.	2d class.	3d class.	1st class.	2d class.	3d class.
Old rates..	3.819	2.864	1.101	2.864	2.148	1.579
New rates..	3.472	2.314	1.528	2.604	1.875	1.222

The new rates are not very different from, but rather

The new rates are not very different from, but rather

higher than, those prevailing in the German Empire; but there is nothing in France approaching the fourth class rate of Prussia.

NEW PUBLICATIONS.

State Railroad Commissions and How They May Be Made Effective.—Under this title Frederick C. Clark, Ph. D., who is instructor in History and Political Economy in the Ann Arbor High School, has prepared, and the American Economic Association has published an octavo pamphlet of 110 pages, besides several folding tables and a map, which discusses the subject named, but whose chief value, it seems to us, and that a very considerable one, is its tabulation of the prescriptions of all the state railroad laws and of the powers and activities of all the state railroad commissions, which makes it easy to ascertain how extensive is the application of the things commanded or forbidden under the several laws. The map shows by different colors the territory over which extends the authority of commissions which have power simply to investigate and recommend, and of those which have authority to regulate directly (and usually to fix rates). This map is apt to mislead the casual observer by giving a color to New Jersey, Pennsylvania, Indiana and Arkansas, which have nothing even remotely resembling railroad commissions, the excuse being that certain officials of these states receive and publish railroad reports or assess the railroads for taxation. This is of some importance, for we naturally look to the map to see where there is nothing to protect enterprise and industry from being crushed by giant monopolies; and from the map we might think it safe to establish a business in New Jersey, or Pennsylvania, or Indiana, where in fact there is no state protection whatever, and where, of course, no sane manufacturer, miner or other person requiring much transportation would venture his capital.

The discussion of the subject by Dr. Clark is in very many points subject to criticism. We shall venture one suggestion which we believe would do more than everything else, laws included, to make state railroad commissions effective, and this is, to select men as commissioners solely on account of their capacity for dealing with the questions which will come before them, and to keep them in office as long as they will stay. Nobody but a man of exceptional ability can make a good railroad commissioner, and such a man, unless he has had a very rare experience previously, needs a good many years to learn his business well. The practice in some states of giving commissioners authority over engineering as well as traffic questions goes near to making it impossible for a railroad commissioner to do well what is required of him. Probably not half a dozen men in the whole country are experts in both traffic and engineering questions, and it is safe to say that none of these will ever be a railroad commissioner. If there are to be government inspectors of roads, rolling stock and accidents—and we would hope for much good from the reports of experts in railroad operation, who should set forth clearly the various negligences and defects which are the cause of most accidents—these should not be interfered with by experts in traffic questions and the like, nor should they interfere with them.

But where the practice prevails of appointing railroad commissioners to pay political debts, or to exercise political influence, there is not much to be hoped from their administration, or from any laws which they may administer.

Road Construction and Maintenance. Prize Essays reprinted from *The Engineering Record*. New York: *The Engineering Record*, 1892. Price: paper 50 cents; cloth, \$1.

Early in 1890 *The Engineering Record* offered three prizes for essays on road making and maintenance. Twenty-one essays were received. A committee consisting of Messrs. F. Collingwood, E. P. North and James Owen examined these essays and rated them. Besides the three which took prizes, four were judged worthy of honorable mention. The three prize essays and abstracts from those receiving honorable mention are here reprinted in a small volume of 110 pages, which is a very handy and fairly good summing up of the best modern practice for country roads, particularly when read with the notes of the committee.

Transactions of the American Institute of Electrical Engineers. Volume VIII., 1891. Ralph W. Pope, Secretary, 12 West Thirty-first street, New York.

The volume contains the records of 12 meetings, beginning with Dec. 16, 1890, and ending with Dec. 16, 1891. More or less of the material which is here collected has been noticed in these columns as the monthly parts have appeared, but as collected in the volume they make a convenient record of very valuable electrical literature. To our readers the most important of the papers probably is that of Mr. O. E. Crosby, on High Speed Electric Railway Work, which was presented at the meeting of Feb. 24, 1891, and discussed at considerable length.

TRADE CATALOGUES.

The Buffalo Forge Company, of Buffalo, N. Y., issues a special catalogue of Planing Mill Exhausters. The catalogue contains price lists, dimensions, tables of speed, etc., for double and single fans. It also contains diagrams showing the arrangement in mills and a number of measurements of hoods from actual examples.

The Rue Manufacturing Company, 116 North Ninth street, Philadelphia, Pa., issue their 1892 catalogue. It shows the Little Giant, the Fixed Nozzle and the Unique injectors and the boiler washing and testing apparatus manufactured by this firm. The pamphlet gives price lists, dimensions and capacity of injectors of different sizes, with instructions for their use.

THE SCRAP HEAP.

Spanish American Notes.

All duties upon imports of coal have been abolished by Uruguay.

The new water works at Caracas, Venezuela, will be opened during the coming summer.

A cotton mill is being erected at Bahia, Brazil, which is expected to be in operation within the year. It is reported that 200 English operators are engaged.

A telegraphic dispatch from San Salvador states that on March 21 a train was derailed at Sonsonate, on the Acajutla Railroad, causing the death of 13 people and the wounding of a still larger number.

Traffic is reported as having begun to increase upon the Central Railway of Paraguay, and new colonies are being planted along the line of the road. Perpetual 5 per cent. debenture stock of this line is now ruling at from 21 to 22.

The customs receipts for February, 1892, at the two ports of Buenos Ayres and Rosario, amounted to \$28,934, reduced to a gold basis. For the same period of 1891 the receipts of these custom houses was only \$7,954. Immigration has also recommenced, the arrivals at Buenos Ayres for January last numbering 6,881.

Messrs. J. Arenca & Co. have applied to the Argentine government for a lease of the General Roca Canal, in the valley of the Rio Negro, for a period of 10 years at \$1,000 a year. They also agree to construct a new reservoir in consideration of the use of the canal. This lease would revive a useful enterprise, now practically abandoned.

The only break now in the Trans-Andine Railroad between Buenos Ayres and Valparaiso is that between Rio Blanco, Argentine, and Juncal, Chili. The Royal Mail Steamship Co. has commenced issuing through tickets from Liverpool to Valparaiso via Buenos Ayres and the Trans-Andine Railroad, and it announces the time between these two points as being only 23 days.

Shipping returns for the port of Valparaiso, Chili, are as follows:

Arrivals:	Vessels.	Tons.
1891.....	1,050	244,499
1890.....	1,267	1,204,145
Departures:		
1891.....	1,022	910,955
1890.....	1,270	1,203,077

A recent issue of the *Chilian Times* says: "It will hardly be credited abroad that a port which is frequented by 35,000 passengers and 2,000,000 tons of shipping a year possesses only one passenger pier, and that scarcely worthy of a fishing village. Is there nobody capable of submitting to the government a plan for a floating pier or a pier of some kind from which passengers could step into or out of a boat or a tender without running the risk of breaking their limbs or losing their lives?"

The receipts of the railroads belonging to the Peruvian Corporation, Ltd., amounted to \$133,033 for the month of February, 1892, being an increase of \$38,986 over the corresponding month of 1891. The Southern Railroad, from Mollendo to Lake Titicaca, including lake traffic, yielded \$65,490, an increase of 43 per cent. over the receipts for February, 1891. The most astonishing improvement under the corporation's management was upon the Truxillo line, 47½ miles, where the receipts have advanced 112 per cent., being \$16,576 for one month. The total number of miles of track under the control of the corporation is 621.

The proposed amalgamation of the Central Argentine and the Buenos Ayres & Rosario railroads continues to absorb the attention of railroad men in Argentine. What will probably prove a fatal blow to the scheme is a circular recently issued by the directors of the Central Argentine, in which an excellent analysis of traffic and expenses on the lines extending from tide water into north central Argentine is given. From this it appears that the receipts per mile per week on the Central Argentine average \$72.90 on 711 miles of road, as against \$57.32 on 843 miles of road on the Buenos Ayres & Rosario. It is also shown that the income needed to meet the fixed charges on the latter road is twice as great as that required by the Central. Attention is called to the strong probability that an amalgamation of these two routes to Buenos Ayres would only result in stimulating the construction of a narrow gauge road from Córdoba to that point. As we recently pointed out, there has been a great stimulus given to trade in northern Argentine by the completion of a narrow gauge road from Rosario to Córdoba, giving through connection over lines of single gauge from Tucuman to the coast, and this has already stimulated the old idea of building a narrow gauge road to Buenos Ayres. Among other objections to the proposed amalgamation are the legislative difficulties, the Argentine law prohibiting, with severe penalties, agreements between railroads intended to do away with competition, and the necessity of securing a special act of Parliament in case a single stockholder should offer a protest against the measure.

Securities Listed on the New York Stock Exchange.

The Governing Committee of the Stock Exchange has listed the following securities:

Akron & Chicago Junction.—\$1,500,000 first mortgage bonds dated Nov. 1, 1890, and running 40 years at five per cent. The interest is guaranteed by the Baltimore & Ohio.

Chicago, St. Paul & Kansas City.—Additional \$125,000 first mortgage five per cent. bonds making the total amount listed \$9,193,000.

Chicago & Northwestern.—Additional \$1,000,000 debenture five per cent. bonds, making the total amount listed \$6,000,000.

Pennsylvania Company.—Additional \$1,250,000 first mortgage 4½ per cent. bonds guaranteed by the Pennsylvania. This completes the entire issue of \$20,000,000.

Chesapeake & Ohio.—Additional \$440,000 consolidated five per cent. bonds, making total amount listed \$22,540,000.

Cleveland, Cincinnati, Chicago & St. Louis.—An issue of \$4,000,000 first mortgage four per cent. bonds of the Cincinnati, Wabash & Michigan Division.

Union Pacific Telegraph.

Justice Brewer, of the United States Supreme Court, sitting as a judge for the Circuit Court embracing the District of Nebraska, rendered a decision at Washington last Wednesday, in the suit brought by the United States against the Western Union Telegraph Company and the Union Pacific Railway Company to annul the contract between the Western Union and the Union Pacific by which the former operates the telegraph lines of the road. The decision is in favor of the United States, sets aside the contract of 1881 between the two companies, and directs the Union Pacific henceforth to operate its own telegraph line by its own agents and not through the instrumentality of the Western Union.

New Coal Shipping Docks at Cornwall.

A contract has been let to Messrs. Ross & Sanford, of Jersey City, to construct a new coal shipping station at Cornwall, N. Y., for the New York, Ontario & Western. It will consist of a bulkhead 900 ft. front on Newburgh Bay, and when filled in will reclaim about eight acres of land. A coal shipping pier will be built 50 ft. wide and 900 ft. long, which will have a shipping capacity of from 3,000 to 4,000 tons of coal a day. A similar plant has recently been constructed for the company by these contractors at Weehawken, N. J. The work, which has been delayed on account of the ice in the Hudson River has just been commenced, and will be completed by July 15. The cost will be between \$150,000 and \$200,000.

Sure Cure for Poverty.

The latest scheme for warding off all the intermittent evils of earthly existence is a plan for "Salary Insurance" which is set forth in a circular issued by Beecher, Schenck & Co., General Managers of the American Casualty Insurance and Security Co., of 120 Broadway, New York City. They are now prepared to issue a policy insuring against loss of salary to employees arising from dismissal from employment, providing such dismissal is caused through no willful act or negligence on their (the employees') part, and also against arbitrary discharge without cause. The insurance is designed to provide against loss of situation from causes over which no clerk has any control, such as fire on the premises, want of capital, dissolution of partnership, transfer or retirement from business, depression of trade, reduction and rearrangement of staff, reduction of several departments, bankruptcy, failure or death of the employer.

One of the seductive paragraphs of the circular consists of a supposititious letter as follows: Mr. Horatio Pickwick: Dear Sir—The executor of the estate of the late C. Bandervilt, having decided to close the business carried on by the deceased, we beg to inform you that your services will not be required on and after the 30th inst.—Respectfully yours, Jacob Rastor, Executor.

This scheme needs no puffing at our hands. It will go like wild-fire on its merits. The policies provide for paying the benefits for only six months after one "gets the sack," but any one can see that the extension of this period to, say, six years, is all that is necessary to meet the wants of at least 50 millions of our citizens. The scheme would be popular in Europe, too. William Hohenzollern, Esq., of Berlin, Ger., has on foot a plan for insuring the happiness of all the people in that country; he would be glad to learn of this.

LOCOMOTIVE BUILDING.

The Receiver of the Kentucky Union has been authorized to purchase several new locomotives, but the appropriation authorized by the court is only \$9,000.

The Schenectady Locomotive Works has orders on its books for about 35 compound locomotives. Twenty-seven of the engines are being built for the Southern Pacific.

Two additional engines for the Jaffa & Jerusalem Railroad have been shipped from New York by the Baldwin Locomotive Works. They are eight wheel, narrow gauge locomotives, Mogul type, similar to the three built for that railroad two years ago.

The Baldwin Locomotive Works have taken an order for 10 suburban engines for the Long Island. They are of the Forney type, with compound cylinders 9 in. and 15 in. diameter by 20 in. stroke; driving wheels 51 in. diameter; estimated weight in working order about 60,000 lbs.; weight on driving wheels about 42,000 lbs.; working steam pressure 180 lbs.; boiler 44 in. diameter, with 140 tubes 1½ in. diameter, 6 ft. 11 in. long; firebox, 50½ in. by 44½ in.; tank, 900 gallons capacity carried over a rear four-wheel truck; to be fitted with vacuum brakes, two headlights, muffled safety valves, steel-tired truck wheels, metallic packing, sight feed lubricator and asbestos lagging.

Recent orders of the Baldwin Locomotive Works include contracts for 15 locomotives from the Philadelphia & Reading, of which four are high speed compound passenger locomotives, duplicates of No. 618; one is a compound 75-ton consolidation engine; and the other ten are single expansion switching engines. Other orders are for two rack locomotives for a road under construction at Florence, Italy, having grades of 22 per cent.; two light inspection locomotives for the Government of Nicaragua, four consolidations for the Buffalo, Rochester & Pittsburgh, duplicates of two built on trial, and also 10 suburban passenger engines for the Long Island road. Altogether the Baldwin Locomotive Works have received orders for 215 compound locomotives up to date.

CAR BUILDING.

The Burton Car Co. is to build 400 stock cars for Armour & Co., of Chicago.

The Louisville & Nashville this week received the first 25 coal cars of 250 recently ordered from the Elliott Car Works at Gadsden, Ala.

The Monterey & Mexican Gulf proposes to order a lot of new coal cars during the spring. The number is not now decided, but will probably be about 300.

The Wabash orders are reported to include the construction of 2,400 new freight cars, 30 day passenger cars, ten vestibule cars, 28 baggage and express cars, eight mail cars, and six observation cars.

BRIDGE BUILDING.

Annapolis, Md.—The following bridge bills are now pending in the Maryland Legislature: providing for the erection of a bridge over Curtis Creek from Walnut Point; a bridge across Choptank River at or near Willis-

ton, in Caroline County; of a new bridge across Black River, in Baltimore County, to replace the old Eastern Avenue bridge.

Brazos, Tex.—The bill authorizing the Velasco Terminal Railway Co. to construct a bridge across the Brazos River, near Brazos, was passed by the United States Senate, March 21.

Catasauqua, Pa.—The Lehigh County Commissioners have awarded to the Groton Bridge Co., of Groton, N. Y., for \$11,505, the contract to build the new iron bridge across the Lehigh River at Lower Catasauqua.

Chester, Pa.—The plans of the bridge to be built over Chester Creek, in Chester, are now ready, and bids for the work have been asked for.

Cleveland, O.—The City Council of Cleveland has now under consideration a bill authorizing an appropriation of \$50,000 for the reconstruction of the Swiss street bridge.

Cincinnati, O.—Proposals are asked by the County Auditor until April 6 for the construction of a bridge on Duck Creek.

Columbus, O.—Proposals are wanted until April 11, by Henry J. Caren, County Auditor, for the erection of two bridges.

Galveston, Tex.—The Missouri Valley Bridge Co. has been awarded a contract at \$175,000 to construct the steel bridge from Galveston Island to the mainland, at Galveston, Tex.

Llano, Tex.—The bridge over the Llano River, the contract for which was recently let to the Wisconsin Bridge Co., of Milwaukee, is to be a steel truss bridge, with three granite piers and approaches. The four spans are to be 400 ft. long and the total length of the bridge 970 ft. The roadway is 18 ft. wide, with a 5 ft. walk on each side.

Saginaw, Mich.—The Common Council on March 28 voted to issue bonds to the amount of \$200,000 for the proposed new bridge work previously authorized.

Toronto, Ont.—The corporation of the city of Toronto have filed plans of the proposed swing bridge in that city across the river Don.

Washington, D. C.—The bill to provide for rebuilding the bridge across Rock Creek, at M Street Northwest, in the District of Columbia, was passed by the Senate, March 22.

RAILROAD LAW—NOTES OF DECISIONS.

Powers, Liabilities and Regulation of Railroads.

The Colorado Constitution declares that all corporations in the state, or doing business therein, shall be subject to taxation on property owned "or used" by them within the limits of the authority levying the tax. The statute, prior to 1889, required that the proper railroad official should report to the state board of equalization all rolling stock owned "or operated," and that the board should assess against the company all property "exclusively used" in operating its road. The Supreme Court holds that the action of the board was not limited to such rolling stock as always remained upon the company's lines and under its immediate control, but its authority included cars which, in performing their regular journeys, passed out of the state and became temporarily useful in operating other railroads. And that under such law a domestic railroad, using and operating cars, could be required to pay the taxes thereon, though the exclusive ownership was in a foreign corporation, with its domicile, principal office and principal place of business in another state.¹

In New Jersey it is held that the section of the railroad law making it the duty of a railroad to construct bridges and passages over, under and across its road where a highway crosses it, of such width and character as shall be suitable to the locality in which it is situated, so that public travel shall not be impeded, merely imposes a duty looking to the reparation of an injury lawfully done the highway, and does not authorize a railroad, in crossing a highway by means of a bridge, to encroach upon the highway by building abutments therein, even though it may leave space enough for travel. In such a case the railroad must bridge the entire width of the highway.²

In Pennsylvania it is laid down by the Supreme Court that a railroad authorized to take for its right of way a strip not exceeding 60 ft. in width is, in the absence of any designation of its boundaries, presumed to have taken the full 60 ft., though the road be located in a street less than 60 ft. wide. This presumption still exists, though the company in the construction of its road does not take actual possession of the land outside the street.³

In Indiana a court authorized a receiver of a railroad company to issue traffic debentures with coupons which should be receivable at par in payment for freight, in an amount not greater "than one-half the amount to be paid by the holder thereof." The road having been sold expressly subject to these debentures, a person frequently receiving freight for several years tendered less than half the sums due in coupons, but the company's agents uniformly refused to receive them, and thereupon the whole freight was paid in cash. In many cases the freight bills as presented included freights upon connecting lines, but the amount due for carriage upon the line subject to the debentures was not separately stated, and no effort was made to ascertain it. Subsequently the person tendering the coupons placed the matter before the general officers of the company, and demanded that the coupons should be received. He was informed, however, that nothing could be done for him, as the company regarded the debentures as illegal and unjust. On again tendering coupons to the local agent, he was threatened with arrest if he made any further tenders. The Appellate Court holds that this constituted a repudiation of the whole contract, and that thereupon all the debentures held by the shipper became due, whether they had ever been tendered or not, and he could maintain an action of *assumpsit* for their par value.⁴

Injuries to Passengers, Employees and Strangers.

The Supreme Court of Mississippi holds that under the state statute which provides that station agents of railroad companies shall preserve order in the waiting rooms, and may arrest and deliver to some officer all persons guilty of disorderly conduct, the acts of such agents are imputable to the company.⁵

The Supreme Court of the United States decides that when a railroad conductor shoots a passenger, under the belief, which is reasonably warranted by the passenger's manner, attitude and conduct, that an immediate as-

sault upon him with a deadly weapon is intended, the company is not liable in damages, although in fact there was no actual danger.⁶

In Indiana the Supreme Court rules that when a railroad accepts passengers on its freight trains it becomes bound by all the obligations of a common carrier of passengers on a regular passenger train.⁷

In Alabama the plaintiff was a passenger for E. in a second class car, with his dog. The conductor told him that, under the company's rules, dogs must go in the baggage car. Plaintiff delivered the dog to the baggage master, and told him to put it off at E., and that he would not pay him any money for the dog. On arriving at E. the baggage master refused to deliver the dog without the payment of 25 cents, which plaintiff refused to give, and the dog was carried further on and lost by the negligence of the baggage master. Plaintiff afterward, and before learning of the loss of the dog, offered to pay what was due on it. The Supreme Court rules that plaintiff could recover for the dog from the company, though it had a rule providing only for the payment of a fee to the baggage master and relieving itself of all liability, plaintiff not being informed of the rule and having no knowledge of it.⁸

In Texas, the evidence showed that the depot at which plaintiff attempted to get off was dimly lighted; that it was too dark for him to see the ground or distinguish objects around him, and that the conductor, when asked by a passenger, who got off just ahead of plaintiff, whether the train did not stop long enough for passengers to get off, flippantly replied that it seemed not. The Supreme Court holds the railroad liable for an injury to the plaintiff received while alighting from the train.⁹

In Alabama the Supreme Court rules that there being evidence that plaintiff was injured while between an engine and a car, in the act of uncoupling them, the court properly refused an instruction that he could not recover unless he was ordered to go in between the engine and car to uncouple the same, since there might have been circumstances under which plaintiff had a right to infer such order from a mere direction to uncouple the car and engine.¹⁰

In Georgia the evidence was that the plaintiff being directed by a conductor to couple an engine and cab to another cab which was stationary, he gave the fireman a car-length signal to slack up, but the fireman did not do so; that he struck the cab, after which, on a signal, he stood still; that plaintiff then went between the cars to make the coupling; that after he had stooped down, and was hammering up the link, which was tight, he suddenly heard the engine exhaust, which it always did when moving; that in running out he stumbled, and, throwing up his hand, struck the dead block, and was caught, his hand being mashed. Plaintiff testified that no rules of the company requiring him to make a coupling in any other way had ever been read or explained to him; that he made his mark to some paper, but could not read, and did not know what it was. There was testimony for defendant contradicting plaintiff's evidence as to the cause of the accident, and the rules of the company were put in evidence, signed by plaintiff, requiring him to proceed otherwise than he did in coupling cars. The rules recited that they had been explained and were understood by the signers, and there was evidence that they had been read to plaintiff when he signed them. The Supreme Court affirms a judgment against the railroad.¹¹

Injuries to Passengers, Employees and Strangers.

In New York the Supreme Court rules that an engineer in the employ of a railroad which uses a track in common with another company, is not, while running an engine on such track, a fellow-servant with the employees of the latter, so as to prevent a recovery by him for injuries received through their negligence.¹²

In Texas a water cask placed on the front of a hand-car was jolted off, causing the overturning of the car and an injury to one of the sectionmen. The cask was placed there by one of the sectionmen, the foreman giving no further directions than that they place their things on the car preparatory to going home. There was no particular place where they were accustomed to place it, but it was sometimes put in one place and sometimes in another. The Supreme Court decides that, though the looseness of the car handles caused it to jolt, and though the foreman had promised to have this fixed, a verdict was properly directed for defendant, the accident having resulted from the intervention of a new and distinct cause—the negligent placing of the cask by plaintiff's fellow-servant.¹³

In South Dakota it is laid down by the Supreme Court that when a railroad, for the use of shippers in loading freight, erects a derrick near its track, so that the arm when in use projects over the track in close proximity to the top of passing freight cars, it is bound, not only to provide proper fastenings to draw back and secure the arm when not in use, but is also bound to place the derrick in charge of a competent servant charged with the duty of seeing that it is properly secured; and it must not only use reasonable care in selecting a competent servant, but must exercise the same care in continuing him in the service. If it fails in such duty it will be liable for injuries caused by the derrick to employees on passing trains, though the derrick may be provided with all proper appliances for rendering it safe.¹⁴

In New York a railroad by which plaintiff was employed as engineer, and defendant used a single track in common between two stations, under rules providing that no train should be started from either unless the train staff for that track was in possession of the engineer. While plaintiff's train, with the staff, was at the easterly station on a foggy night one of the defendant's engineers received permission from the main office, through the operator at the westerly station, to flag up such track by running preceded by a flagman with a light, and was told by the operator, after the latter had apparently telegraphed for information, that plaintiff's train was not expected down before 6 or 7 o'clock next morning. On the way up the flagman's lamp became extinguished, but the engine proceeded until plaintiff's train came in sight. A collision appearing to be imminent, plaintiff jumped from his engine, and sustained serious injuries. The Supreme Court holds that these facts show negligence on the part of the defendant.¹⁵

In Michigan it is laid down by the Supreme Court that railroads are not held to the same degree of care in maintaining their side tracks as their main tracks, and are not liable for injuries caused by defects in their construction, unless it appear that they are guilty of gross carelessness in handling their cars.¹⁶

In Georgia it appeared that the plaintiff was told by the conductor to couple stationary cars to cars attached to an engine; that, after the engine had stopped at his signal, he gave a standstill signal, and went between the cars to make the coupling; that the position of the cars rendered a forced coupling necessary; and that while he was making it the engine moved, and caught

his hand between the draw heads, mashing it. He had only been employed a little over a month, and he stated as an excuse for not using a stick in coupling, as required by defendant's rules, that he did not know of the rule; that he had a stick furnished by defendant, but had left it on the engine; that the sticks were used in putting brakes on heavily loaded cars, but that he was not told to use them for coupling, and that the conductor had seen him make couplings with his hands; that the conductor gave the engine the signal which caused him to move the engine. The evidence for defendant was to the effect that, before the engine moved, plaintiff called to "come ahead a little," and that the conductor transferred the signal to the engineer; that plaintiff, when on the engine, after being injured, said that he alone was to blame for the accident, but this was contradicted by plaintiff; that plaintiff knew the rules requiring sticks to be used in coupling, and had been told of them by the conductor. The Supreme Court holds the railroad liable.¹⁷

In Minnesota the Supreme Court rules that an employee of a railroad who works on the tracks for several hours at a place where ties are piled near the tracks, assumes the risk of their preventing his getting out of the way of a train.¹⁸

In the Federal Court it is held that a railroad cannot escape liability or negligence in repairing a track on the ground that it was the negligence of the instate's fellow-servants, when the company's roadmaster was present, and in charge of the whole work of reconstruction.¹⁹

In Georgia the Supreme Court holds that a person in a public hack is under no duty to supervise the driver at a railroad crossing, nor to look or listen for approaching trains, unless she has some reason to distrust the diligence of the driver, and if she is injured by the negligence of the railroad even though the hackdriver was also negligent the railroad is liable.²⁰

On the same principle the Supreme Court of New York holds that a persons riding by invitation in a carriage, and injured by collision with a railroad engine and cars at a street crossing by reason of the negligence of those operating the engine and cars, may recover against the railroad company, notwithstanding the contributory negligence of the driver of the carriage, a servant, whose negligence cannot be imputed to the guest.²¹

In California the Supreme Court rules that where a child six years old was injured on a turn-table while playing with other children, no employee being about, and the turn-table was only kept in place by an ordinary iron latch, which could be easily lifted, the company is liable for injuries received by the child while the table was turned by other boys, even though the employees of the company had always ordered children away when observed playing on the turn-table.²²

- ¹ D. & R. G. Ry. Co. v. Church, Pac. Rep., 468.
- ² Baritan v. Port Reading R. Co., 23 Atl. Rep., 127.
- ³ Jones v. Erie & W. V. R. Co., 23 Atl. Rep., 251.
- ⁴ E. & L. R. Co. v. Frank, 29 N. E. Rep., 419.
- ⁵ King v. Illinois Cent. R. Co., 10 South. Rep., 42.
- ⁶ N. O. & N. E. R. Co. v. Jones, 12 S. Ct. Rep., 109.
- ⁷ Pennsylvania Co. v. Newmeyer, 28 N. E. Rep., 880.
- ⁸ C. C. & B. R. Co. v. Higdon, 10 South. Rep., 282.
- ⁹ G. H. & S. A. R. Co. v. Thornberry, 17 S. W. Rep., 521.
- ¹⁰ M. & O. R. Co. v. George, 10 South. Rep., 145.
- ¹¹ R. & D. Co. v. Wright, 13 S. E. Rep., 820.
- ¹² Gross v. P. P. & B. R. Co., 16 N. Y. S., 616.
- ¹³ Rose v. Gulf, C. & S. F. Ry. Co., 17 S. W. Rep., 789.
- ¹⁴ Gates v. C. M. & St. P. Ry. Co., 50 N. W. Rep., 907.
- ¹⁵ Gross v. P. P. & B. R. Co., 16 N. Y. S., 616.
- ¹⁶ O'Donnell v. Duluth, S. S. & A. Ry. Co., 50 N. W. Rep., 801.
- ¹⁷ R. & D. R. Co. v. Williams, 14 S. E. Rep., 120.
- ¹⁸ Bengston v. C. St. P. M. & O. Ry. Co., 50 N. W. Rep., 331.
- ¹⁹ A. T. & S. F. R. Co. v. Wilson, 48 Fed. Rep., 57.
- ²⁰ East Tenn. Co. v. Markens, 15 S. E. Rep., 855.
- ²¹ McCaffrey v. D. & H. Canal Co., 16 N. Y. S., 495.
- ²² Callahan v. Bel River & E. R. Co., 28 Pac. Rep., 104.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Delaware, Lackawanna & Western, quarterly 1½ per cent., payable April 20.
Evansville & Terre Haute, annual, 5 per cent., payable April 15, in general mortgage 5 per cent. bonds.
Freehold & Jamesburg Agricultural, annual, 3 per cent., payable April 1.
Great Northern, quarterly, 1½ per cent. on the preferred stock, payable May 2.
Northern (N. H.), quarterly, 1½ per cent., payable April 1.
Panama, 2 per cent., payable March 28.
Rio Grande Western, quarterly, 1½ per cent. on the preferred stock, payable May 2.
Toledo & Ohio Central, quarterly, 1½ per cent. on the preferred stock, payable April 25.
Utica & Black River, semi-annual, 3½ per cent. guaranteed, payable March 30.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Chesapeake, Ohio & Southwestern, annual, Memphis, Tenn., April 4.
Chicago & Alton, annual, Chicago, Ill., April 4.
Chicago & Grand Trunk, annual, Chicago, Ill., April 13.
Cincinnati, Saginaw & Mackinaw, annual, Saginaw, Mich. (East Side), April 19.
Galveston, Houston & Henderson, annual, Galveston, Tex., April 5.
Harlem River & Port Chester, annual, Grand Central Depot, New York City, N. Y., April 9.
Herkimer, Newport & Poland, special New York, N. Y., April 4.
Herkimer, Newport & Poland Extension, special, New York, N. Y., April 4.
Joliet & Chicago, annual, Chicago, Ill., April 4.
Lake Shore & Michigan Southern, annual, Cleveland, O., May 4.
Little Rock & Fort Smith, annual, Little Rock, Ark., April 28.
Long Island, annual, Jamaica, N. Y., April 12.
Michigan Central, annual, Detroit, Mich., May 5.
Morgan's Louisiana & Texas Railroad & Steamship Co., annual, New Orleans, La., April 4.
New Orleans & Carrollton, New Orleans, La., April 6.
New York Central & Hudson River, annual, New York, N. Y., April 20.
New York, Ontario & Western, New York, N. Y., April 20.
Panama, annual, New York, N. Y., April 4.
Philadelphia & Long Branch, annual, Camden, N. J., April 4.

Pittsburgh, Cincinnati, Chicago & St. Louis, annual, Pittsburgh, Pa., April 12.
St. Louis, Iron Mountain & Southern, special, St. Louis, Mo., May 27.

St. Louis Southwestern, annual, St. Louis, Mo., May 4.
St. Lawrence & Adirondack, special, New York, N. Y., April 4.

Southern Central, special, Philadelphia, Pa., April 12.
Southern Pacific, annual, San Francisco, Cal., April 6.
Traverse City, annual, Traverse City, Mich., May 5.
Union Pacific, Denver & Gulf, annual, Denver, Col., April 12.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *American Railway Association* will hold its spring meeting at New York City, April 13.

The *National Association of Car Service Managers* will hold its next annual meeting at Philadelphia, Pa., April 27.

The *Association of Railway Accounting Officers* will hold its fourth annual meeting at the Auditorium Hotel, Chicago, Ill., May 25.

The *Master Car Builders' Association* will hold its annual convention at Congress Hall, Saratoga, N. Y., June 15.

The *American Association of General Baggage Agents* will hold its next annual meeting at Mackinac Island, Mich., July 20.

The *New England Railroad Club* holds regular meetings at the United States Hotel, Beach street, Boston, Mass., on the second Monday of each alternate month, commencing January.

The *Western Railway Club* holds regular meetings on the third Tuesday in each month, except June, July and August, at the rooms of the Central Traffic Association in the Rookery Building, Chicago, at 2 p. m.

The *New York Railroad Club* holds regular meetings on the third Thursday in each month, at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, N. Y.

The *Southern Railway Club* holds regular meetings on the third Thursday of the months of January, February, March, May, September and November at such points as are selected at each meeting.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, the fourth Wednesday of January, March, May, September and November. By special resolution the next meeting will be held in April.

The *Northwest Railroad Club* meets on the first Saturday of each month, except June, July and August, in the St. Paul Union Station, at 7:30 p. m.

The *Northwestern Track and Bridge Association* meets on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m. in the directors' room of the St. Paul Union Station.

The *American Society of Civil Engineers* holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third street, New York.

The *Boston Society of Civil Engineers* holds its regular meetings at the American House, Boston, at 7:30 p. m., on the third Wednesday in each month.

The *Western Society of Engineers* holds its regular meetings at 78 La Salle street, Chicago, at 8 p. m., on the first Wednesday in each month.

The *Engineers' Club of St. Louis* holds regular meetings in the club's room, Laclede Building, corner Fourth and Olive streets, St. Louis, on the first and third Wednesday in each month.

The *Engineers' Club of Philadelphia* holds regular meetings at the House of the Club, 1,122 Girard street, Philadelphia, on the first and third Saturday of each month. The annual meeting is held on the third Saturday in January. The club stands adjourned during the months of July, August and September.

The *Engineers' Society of Western Pennsylvania* holds regular meetings on the third Tuesday in each month, at 7:30 p. m., at its rooms in the Thaw Mansion, Fifth street, Pittsburgh, Pa.

The *Engineers' Club of Cincinnati* holds its regular meetings at 8 p. m., on the third Tuesday of each month in the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati.

The *Civil Engineers' Club of Cleveland* holds regular meetings on the second Tuesday of each month, at 8 p. m., in the Case Library Building, Cleveland. Semi-monthly meetings are held on the fourth Tuesday of the month.

The *Engineers' Club of Kansas City* meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The *Engineering Association of the South* holds its monthly meetings on the second Thursday at 8 p. m. The Association headquarters are at Nos. 63 and 64 Baxter Court, Nashville, Tenn.

The *Denver Society of Civil Engineers and Architects* holds regular meetings at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesday of each month, at 8 o'clock p. m., except during June, July and August, when they are held on the second Tuesday only.

The *Civil Engineers' Society of St. Paul* meets at St. Paul, Minn., on the first Monday in each month.

The *Montana Society of Civil Engineers* meets at Helena, Mont., at 7:30 p. m., on the third Saturday in each month.

The *Civil Engineers' Association of Kansas* holds regular meetings at Wichita on the second Wednesday of each month at 7:30 p. m.

The *American Society of Swedish Engineers* holds meetings at the club house, 250 Union street, Brooklyn, N. Y., and at 247 North Ninth street, Philadelphia, on the first Saturday of each month.

The *Engineers' Club of Minneapolis* meets the first Thursday of each month in the Public Library Building, Minneapolis, Minn.

The *Canadian Society of Civil Engineers* holds regular meetings at its rooms, 112 Mansfield street, Montreal, P. Que., every alternate Thursday except during the months of June, July, August and September.

The *Association of Civil Engineers of Dallas* meets at 803 Commerce street, Dallas, Tex., on the first Friday of each month at 4 o'clock p. m.

The *Technical Society of the Pacific Coast* holds regular meetings at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., at 8 o'clock p. m., on the first Friday of each month.

The *Tacoma Society of Civil Engineers and Architects* holds regular meetings on the third Friday of each month, in its rooms, 201 and 202 Washington Building, Tacoma, Wash.

The *Engineers and Architects' Club of Louisville* holds regular meetings on the second Thursday of each month, at 8 o'clock p. m., at its rooms in the Norton Building, Louisville, Ky.

The *Association of Engineers of Virginia* holds reg-

ular meetings at Roanoke, on the second Saturday in each month, at 8 p. m., except the months of July and August.

National Convention of Railroad Commissioners.

Secretary Moseley has issued the call for the next national convention of Railroad Commissioners, to be held at the office of the Interstate Commerce Commission in Washington, April 13. The Railroad Commissioners of all states and state officers charged with any duty in the supervision of railroads or railroad interests are invited. The Association of American Railway Accounting Officers is also invited to meet with the Commissioners or to send delegates. Members are asked to notify Edward A. Moseley, Secretary, Washington, D. C., before the day of meeting, of any subjects they may wish to bring up.

PERSONAL.

—Mr. George T. Anthony was this week re-elected a member of the Missouri State Board of Railroad Commissioners.

—Mr. James A. Norton, who was appointed Railroad Commissioner of Ohio in April, 1890, by Governor Campbell, has offered his resignation, to take effect May 1.

—Mr. S. T. Pope, formerly Superintendent of the Duluth & Iron Range and subsequently Assistant General Manager of the Minnesota Iron Co., died of consumption a few days ago in California.

—Hon. Alfred C. Chapin has qualified as State Railroad Commissioner of New York, and took the oath of office March 29. Mr. Chapin will retain his seat in Congress until a final vote on the silver bill is taken.

—General E. P. Alexander resigned the Presidency of the Central of Georgia this week, and Mr. H. M. Comer, a merchant of Savannah, and also President of the South Bound Railroad, was elected President to succeed him.

—Mr. Jacob W. Miller, who has been General Manager of the New York, Providence & Boston since 1886, and who is also President of the Providence & Stonington Steamship Co., was this week elected Second Vice-President of the New York, New Haven & Hartford, which has acquired control of these properties.

—Mr. Rollin H. Wilbur, who has been assistant to the Second Vice-President of the Lehigh Valley road for a number of years, was this week appointed assistant to the General Manager of the Philadelphia & Reading, with office at Philadelphia. Mr. Wilbur is a son of President Wilbur, of the Lehigh Valley, and is now about 30 years old.

—Mr. John C. McKenna, the new General Manager of the Bradford, Bordell & Kinzua road, has been Superintendent since 1885. He has been connected with the road since June, 1881, and has since been a station agent, auditor, and General Freight and Passenger Agent of the road and of the Bradford, Eldred & Cuba and Tonawanda Valley & Cuba roads.

—Mr. C. S. Mellen has been appointed General Manager of the New York & New England. Mr. Mellen was originally with the Boston & Lowell, and left that road in May, 1888, to accept the position of Purchasing Agent of the Union Pacific. He has filled several prominent positions with the latter company, resigning the office of General Traffic Manager to assume his new office. He is about 41 years old.

—William Kirkby, of Toledo, has been appointed Commissioner of Railroads and Telegraphs of Ohio, vice Mr. J. A. Norton, resigned, for the term ending March, 1893. The new commissioner was for some years a railroad conductor and was general yardmaster of the Lake Shore & Michigan Southern at Toledo. For the last two years he has held a city position at Toledo. Mr. Kirkby is a Knight of Labor and a member of several of the railroad unions.

—Judge R. H. Cochran, President of the Wheeling Bridge & Terminal Co., resigned last week, and has been succeeded by Mr. W. H. Thomas, of Boston, who is said to be the largest individual stockholder of the company. Judge Cochran organized the company in 1882 and has been an active promoter of the project for 10 years. He was the President of the Wheeling & Harrisburg between 1882 and 1884, and later of the Union Bridge & Railway Co., and was elected President of the Wheeling Bridge & Terminal Co. on the death of Col. George P. Bissell.

—Mr. John Givin, Superintendent of the Iowa Division of the Chicago, Rock Island & Pacific, died at Des Moines, Ia., March 24. He was 60 years old, and had been in active railroad service continuously for 28 years, being connected all that time with railroads in Iowa. Mr. Givin had been Division Superintendent of the Rock Island since 1880, but was for a number of years previously connected with the traffic department of Iowa roads, and was General Freight Agent and also Superintendent of the Des Moines Valley road, General Freight Agent of the Keokuk & Des Moines, and later Division Freight Agent of the Rock Island.

—Mr. Ario Pardee, a very wealthy coal operator and banker, of Hazleton, Pa., died in Florida March 27, at an advanced age. He was a civil engineer in early life, his first work being on the construction of the Delaware and Raritan Canal, in New Jersey, during 1830-33. He had charge of an engineering corps running the line for the Beaver Meadow Railroad, and in 1836 he began the Hazleton Railroad. Settling there in 1840 he opened coal mines, which being located in the anthracite field, proved exceedingly valuable. In 1848 he built a gravity railroad to Penn Haven, a distance of 14 miles, as an outlet for the product of these mines, but in 1854 the Lehigh Valley Railroad was opened, which caused the abandonment of the old road in 1860. Subsequently he became interested in iron manufacture, and in 1888 owned blast furnaces at various places in New York, New Jersey, Virginia and Tennessee. He was a director of the Lehigh Valley, North Pennsylvania and other railroads. He was a liberal benefactor of Lafayette College, his gifts amounting to over \$500,000.

ELECTIONS AND APPOINTMENTS.

Astoria & Portland.—The company has been incorporated in Oregon by Henry Failing, Frank Denum, T. F. Osborn, J. Frank Watson, Charles H. Dodd, of Portland, Or.; D. K. Warren, I. W. Case, M. M. Ketchum, of Astoria; J. M. Shultz and Thomas H. Tongue, of Hillsboro, Or.

Atlanta & Florida.—Receiver Plant announces that William J. Matthews has been appointed Treasurer for the Receiver.

Bayfield, Lake Shore & Western.—The officers of the company are: President, Capt. H. D. Pike; Vice-President, Frank Boutin; Secretary, W. W. Downs; Treasurer, William Knight; all of Bayfield, Wis.

Bradford, Bordell & Kinzua.—The following directors were elected last week at a meeting in Bradford, Pa.: President, George L. Roberts; Vice-President, H. K. Pomroy; General Manager, J. C. McKenna; Treasurer, W. R. Diffenback; Directors, George L. Roberts, D. H. Jack, John J. Carter, J. B. McGeorge, J. R. Pomroy, H. K. Pomroy and Charles Dana.

California Midland.—The first directors elected are Ludwig M. Hoeller, Charles E. Ertz, Finlay Cook, Robert E. Grayson and Kenneth Williams.

Calumet Belt.—The incorporators and first Board of Directors of this Illinois company are B. F. Ayer, Henry DeWolf, John Dunn, E. P. S. Kene and W. G. Bruen, all of Chicago.

Central New England & Western.—The office of C. A. Hayes, General Freight and Passenger Agent of this company, now at Poughkeepsie, N. Y., will be removed to Hartford, Conn., on April 15.

Central Ontario.—The annual meeting was held last week. The following were elected Directors: George Burke, H. B. Payne and H. P. McIntosh, of Cleveland, O.; David McLaren and Alexander McLaren, of Buckingham, Que.; Charles McGee, of Ottawa, and J. Lyons Biggar, of Belleville. Judge Burke was elected President, Alexander McLaren Vice-President.

Central Vermont.—The following new directors were elected this week: Dr. William Seward Webb, of Shelburne, Vt.; John Bell, of Belleville, Ont.; Robert Colt, of New London, Conn., and Col. F. Stewart Stranahan, of St. Albans, Vt. Of the new directors Dr. Webb is President of the Wagner Palace Car Co., John Bell is Solicitor for the Grand Trunk, Robert Colt is President of the New London Northern and F. S. Stranahan is a prominent business man of Vermont.

Chicago, Fort Madison & Des Moines.—At a meeting of the directors of the company, held in Chicago, March 26, the following officers were elected: D. B. Dewey, Chicago, Chairman of the Board; C. C. Wheeler, Chicago, President; J. F. Tucker, Chicago, Vice-President and General Manager; E. F. Potter, Fort Madison, Ia., General Superintendent; E. C. Long, St. Paul, Treasurer; E. H. Skinner, Birmingham, Ia., Secretary and Assistant Treasurer.

Cleveland, Cincinnati, Chicago & St. Louis.—The Cincinnati, Wabash & Michigan road on April 1 becomes the Michigan division of this system, and the authority of the general officers has been extended over the line. General Manager N. P. Ramsey, Treasurer Norman Beckley, General Passenger Agent W. R. Baldwin and General Freight Agent D. F. Coe have resigned those offices. Chauncey J. Stedwell, recently transferred from the Cleveland to the Indianapolis division, has been appointed Superintendent of the Michigan division of the system. Mr. Stedwell will be succeeded by Superintendent Thomas Reynolds, of the Sandusky division, and the latter will be succeeded by S. T. Blizard, now Trainmaster on the Chicago division.

The headquarters of William Gibson, Superintendent of the Springfield division, have been removed from Springfield, O., to Cincinnati.

Dardanelle & Mount Nebo.—The directors of this company, whose incorporation was noted last week, are as follows: W. J. Thompson, W. B. Worthen, C. A. Pratt, U. M. Rose, Little Rock, Ark.; H. C. Cunningham, Thomas Cox, Thomas Wilson, Dardanelle, Ark.; and Joseph Evans, Mount Nebo. The officers of the company are: W. J. Thompson, President; Thomas Cox, Vice-President; C. A. Pratt, General Manager and Secretary; W. H. Gee, Treasurer, and W. B. Worthen, Assistant Treasurer.

Delaware & Hudson Canal Co.—The vacancies in the Board of Directors in this company have been filled by the election of A. E. Orr, representing the interest of the David Dows estate, and O. P. C. Billings, representing the estate of the late Frederick Billings.

Denver & El Paso Independent.—The following are the first directors of the company: John Evans, Charles B. Kountze, James B. Grant, Samuel H. Elbert, Thomas M. Patterson, Henry M. Porter, of Denver, Col.; Mahlon D. Thatcher, James N. Carlile, of Pueblo; Delos A. Chappell, of Trinidad, Col.; Oliver L. Houghton and Jefferson Reynolds, of Las Vegas, New Mex.; John Y. Hewitt, of White Oaks, New Mex., and Joseph Magoffin, of El Paso, Tex.

Duluth, Mississippi & Northern.—The incorporators are A. W. Wright, of Alma, Mich.; Charles W. Wells, Farnam C. Stone, Charles H. Davis and Willis T. Knowlton, Saginaw, Mich.

Everett & Monte Cristo.—The company has been organized in Washington by Schuyler Dwyer, H. A. Schenck, G. S. Brown, F. H. Brownell and R. T. Murray, all of Everett, Wash.

The following officers have been elected: President, George S. Brown, Everett, Wash.; Vice-President, Robert D. Murray, New York; Secretary, F. H. Brownell, Everett; Treasurer, Henry A. Schenck, New York City; Assistant Treasurer, Schuyler Dwyer, Everett, Wash.

Geneva, Florida & Pensacola.—The incorporators are W. C. McLaughlin, J. S. Collins, of Geneva, Ala.; W. B. Gilmer, C. B. Rencher, of Birmingham, and others.

Grand Rapids & Indiana.—James Kegan has been appointed Master Mechanic of the road to succeed L. T. Bradley, deceased.

Great Northern.—C. H. Jenks, Superintendent of the Dakota division, with headquarters at Larimore, N. Dak., has been transferred to the Northern division, with headquarters at Barnsville, Minn., succeeding Howard James, resigned. E. J. Evans, Assistant Superintendent of the Fergus Falls division, with headquarters at St. Cloud, Minn., has been promoted to succeed Mr. Jenks.

Helena, Missouri River Valley & Easton.—The incorporators are A. F. Foote, Stephen Carpenter, John D. Wilson, Arthur G. Lombard and W. H. Little, all of Helena, Mont., which is the headquarters of the company.

Helena, White Sulphur Springs & Castle.—The company has been incorporated in Montana by L. H. Hersh,

field, H. M. Patchen, A. M. Holter, A. J. Seligman, D. A. Cory and W. A. Chessman, all of Helena, Mont.

Illinois Central.—R. O. Pease, of Chicago, has been appointed Superintendent of Bridges and Buildings on the main line of the Louisiana Division, with office at New Orleans. N. Harrel has been appointed Superintendent of Bridges and Buildings on the Yazoo Division.

Jonesville & Lockhart Shoals.—At a meeting of the stockholders of the company at Union, S. C., March 8, for the purpose of organizing, the following directors were elected: Joseph Walker, C. E. Flemming and D. R. Duncan, of Spartanburg, S. C., and W. H. S. Harris, T. L. Hames, C. D. Farrar and J. H. Spears, of Jonesville, S. C. At a subsequent meeting of the directors, Mr. C. D. Farrar was elected President.

New York & Boston.—The following are the incorporators: Charles H. McKinney, John J. Amory, Curtis P. Harmon, N. W. Vandegrift, Lucius Beaumont, of New York City; Edward V. Cary, of Montclair, N. J.; Medad E. Stone, of New Brighton, N. Y.; George W. Lessels, of Brooklyn; Clayton Mayo and W. Frank West, of Morris Heights, N. Y.

New York Central & Hudson River.—The organization of the freight department has been changed, and four division freight agents appointed. George E. Terry, agent at Troy, has been promoted to be Division Freight Agent at Buffalo, with jurisdiction east to Rochester. E. H. Croly, Agent of the Merchants' Dispatch at Syracuse, has been given charge on the western division lying between Syracuse and Rochester, with office in Rochester. Seneca Kelly, now Local Freight Agent at Syracuse, will take charge of the Mohawk division, with office at Syracuse, and John R. Collins, now on the Harlem division, will have charge of the Hudson River division.

New York & New England.—C. S. Mellen has been appointed General Manager, to take effect April 2. His headquarters will be at Boston.

Norfolk, Wilmington & Charleston.—The following officers were elected last week under the South Carolina charter: A. A. Gaddis, President; H. E. Young, Vice-President and K. S. Tupper, Secretary and Treasurer.

Old Colony Steamboat Co.—O. H. Taylor has been appointed Assistant General Passenger Agent of this company, with headquarters at Pier 28, North River.

Philadelphia & Reading.—The following appointments have been announced in the past week: Rollin H. Wilbur, Assistant to the General Manager, with office at No. 227 South Fourth street, Philadelphia. William C. Anderson, formerly Treasurer of the Lehigh Valley, to be Assistant General Purchasing Agent and Edward H. Mahler, Second Assistant Purchasing Agent. The changes in the traffic department include: E. B. Byington, formerly General Passenger Agent of the Lehigh Valley, Western Passenger Agent, with headquarters at Buffalo, N. Y.; P. H. Wyckoff, formerly General Freight Agent of the Central of New Jersey, Assistant General Freight Agent in charge of local traffic, with office at No. 143 Liberty street, New York City; F. W. Stone, Assistant General Freight Agent, Main Line and Williamsport Divisions, with office at No. 203 South Fourth street, Philadelphia; J. H. Fowkes, Foreign Freight Agent, Philadelphia; J. H. Heckman, Assistant General Freight Agent, Eastern and Northern Divisions, office at Bethlehem; W. S. Speirs, Assistant General Freight Agent, in charge of through traffic, points west of Buffalo, Pittsburgh and Wheeling, office at Bethlehem; T. J. Klase, General Eastern Freight Agent, with office at No. 235 Broadway, New York City; H. C. Tucker, General Western Freight Agent, with office at No. 305 Rookery Building, Chicago; Peter C. Doyle, General Northern Freight Agent, with office at corner Main and Seneca streets, Buffalo.

The changes in the Auditing Department include: Isaac McQuilkin appointed Assistant Comptroller, office at No. 227 South Fourth street, Philadelphia; Charles H. Webb, Assistant Auditor Merchandise Traffic; W. W. Weaver, Assistant Auditor Coal Traffic; Llewellyn Snowden, Assistant Auditor Passenger Traffic.

Pittsburgh, Wheeling & Kentucky.—The annual meeting of the stockholders was held in Pittsburgh, March 25. It resulted in the re-election of the old Board of Directors, as follows: William P. Hubbard, John McLure, Joseph Speidel, Henry K. List, Thomas D. Messler and James McCrea.

Portland & Pacific.—The company has been incorporated by D. W. Lichtenhaler, A. C. Rowland and L. D. Lounsdaile, of Portland, Or.

St. John's River & Gulf.—The company has been chartered by Thomas B. Reed, George P. Westcott, F. E. Richards and Lorenzo Taylor, of Portland, Me.; S. P. Sharples, of Boston, Mass.; John W. Ashby, of Gainesville, Ga., and G. B. Griffin, of Windsor, Fla.

St. Lawrence.—The company has been chartered in New York, as noted last week. The directors are: Charles J. Pusey, F. O. Bassler, Robert J. Hervey, Clark R. Griggs, S. D. Schuyler, of New York; Melville F. Brown, of Toronto, Can.; Lucien B. Howland, of Irondale, Ont.; Richard J. Bright, of Washington, and Richard T. Colburn, of Elizabeth, N. J. The principal office of the company will be in New York.

St. Louis, Arkansas & Texas.—A. S. Dodge, Traffic Manager of the Missouri, Kansas & Texas, has been appointed Freight Traffic Manager of this road, with headquarters at St. Louis. He succeeds L. F. Day, appointed Traffic Manager of the Louisville, New Orleans & Texas.

St. Louis & Cairo.—At the annual meeting held in Chicago on March 15 the following officers were re-elected: J. A. Horsey, No. 17 William St., New York, President; Charles Hamilton, Waco, Texas, Vice-President. Paul W. Abt, East St. Louis, was elected Secretary to succeed William Ritchie, of Chicago. The general offices of the company were removed from Chicago to East St. Louis. The road is leased to the Mobile & Ohio for 45 years, from Feb. 1, 1888.

St. Louis & East St. Louis Terminal.—The incorporators of the company recently chartered in Illinois are: Isaac L. Morrison, David W. Ryder, Francis Hook, William S. Hook and Marcus Hook, all of Jacksonville, Ill.

San Luis & San Joaquin.—The executive committee, as recently organized, includes John H. Wise, of San Francisco, Chairman; Myron Angel, San Luis Obispo, Cal., Secretary; R. E. Jack, San Luis Obispo; H. D. Coulson, O. J. Woodward, Fresno, Cal.; James Deitrich, H. H. Francisco, E. Newman, Tulare; S. W. Ferguson and H. Hirschfeld, Kern, Cal.

Seattle, Lake Shore & Eastern.—The following circular was issued by the treasurer on March 24, the changes taking effect April 1. The Assistant Treasurer's office will be removed from Seattle, Wash., to St. Paul, Minn., and all correspondence pertaining to the funds of the company should be addressed to C. A. Clark, Assistant Treasurer, St. Paul. The accounting offices have been removed from Seattle, Washington, to St. Paul, Minnesota. The following appointments are announced: E. H. C. Taylor, Auditor Traffic Receipts; A. S. Morton, Auditor Disbursements; C. C. Cumiskey, Auditor Motive Power Accounts.

Sioux City, Baltimore & Chicago.—The Directors of the company are T. P. Gere, N. Desparois, E. P. Stone, D. A. Holmes, W. H. Beck, John Peirce, W. P. Manley, A. L. Stetson and D. T. Hedges, of Sioux City. An organization has been effected by the election of the following officers: N. Desparois, President; T. P. Gere, Vice-President; E. P. Stone, Treasurer; S. W. Adams, Secretary.

Springfield, Pawnee & Southern.—The following are the first directors elected by this Illinois company: John White and Henry R. Davis and Hiram M. White, G. C. Clayton and Luther K. Davies, of Pawnee, Ill., and Columbus White, of Taylorville, Ill.

The Concord & Montreal.—E. F. Mann has been appointed Superintendent, office at Concord, N. H. The office of Superintendent of Train Service has been abolished. After April 1 the Northern Division will include all the roads operated by this company north of Concord, N. H. Geo. E. Cummings, Assistant Superintendent, Woodsville, N. H. The Southern Division will include all the roads operated by this company south of and including Concord; W. G. Bean, Assistant Superintendent, Concord.

Wheeling Bridge & Terminal Co.—The company has been recently reorganized and the following new directors elected: R. H. Cochran, of Toledo; W. A. Wilson and N. E. Whitaker, of Wheeling, W. Va.; W. B. Thomas and R. Stearns, of Boston; A. H. Olmstead, of Hartford, Conn.; J. Kennedy Tod, R. H. Rochester and R. B. Ferris, of New York. The new directors have elected W. B. Thomas, President; J. Kennedy Tod, of New York, Vice President, and R. B. Ferris, of New York, Secretary.

Wisconsin Central.—A circular has been issued announcing the removal of the accounting office from Chicago to St. Paul, under the immediate charge of the following officers: M. P. Martin, Auditor; E. H. C. Taylor, Auditor Traffic Receipts; A. S. Morton, Auditor of Disbursements; C. C. Cumiskey, Auditor of Motive Power Accounts. The position of local treasurer at Chicago has been abolished and the jurisdiction of C. A. Clark, Assistant Treasurer of the Northern Pacific, extended to include the duties of that office.

RAILROAD CONSTRUCTION, Incorporations, Surveys, Etc.

Akron & Eastern.—William Semple, Jr., of Allegheny, the President of the road, is given authority for the statement that the contract for constructing this line in Eastern Ohio will be let at once. Several routes are under consideration and as soon as the directors decide upon the line it is proposed to begin grading with a large force. It is hoped that this can be done during April. The road is projected as an extension of the Pittsburgh, Akron & Western, from Akron, O., to Newcastle, Pa., about 70 miles, connecting with the Western New York & Pennsylvania at the latter town.

Astoria & Portland.—Schofield & Goss, who were recently awarded the contract by the citizens committee of Astoria, O., to complete the grading from the present terminus of this road to Hillsboro, began the work to Astoria last week.

Austin & Northwestern.—The contractors have completed about six miles of the tracklaying on the Llano extension west of Fairland, Tex., and the track will probably reach the Colorado River this week. The work west of the Colorado River is being rapidly pushed by the contractors, Ricker, Lee & Co., of Galveston, and the stone work for the bridge will soon be all in place.

Bangor & Aroostook.—The locating work on this road is now practically completed, and nothing further can be done by the surveyors until the location has been approved by the State Railroad Commissioners. It is expected that the approval will be given in a few weeks. The company then expects to be prepared to let the contracts for constructing the road. The main line will extend from Milo, the northern terminus of the Bangor & Piscataquis, recently leased by the company from the city of Bangor, Me., northwesterly through Presque Isle, to Van Buren, Me., with a short branch to Fort Fairfield and a longer one to Ashland. There will be considerable bridge work, mostly short spans, but the grading will be comparatively easy. The quantity of excavation will be less than 15,000 cu. yds. to the mile, and the rock work will be comparatively light. The heaviest work is on the Fort Fairfield branch, where the grades will be 1½ per cent. and the curvature eight degrees. The principal villages on the line and very near it are Brownville, Sherman, Patten, Island Falls, New Limerick, Houlton, Monticello, Bridgewater, Blaine, Presque Isle, Caribou and Van Buren; on Fort Fairfield Branch are Sprague's Mill and Fort Fairfield, and on the Ashland Branch are Smyrna Mills, Masardis and Ashland. The bridge work includes the erection of five 150 ft., twelve 100 ft., one 80 ft., four 75 ft., four 70 ft., two 60 ft., ten 50 ft., four 40 ft., five 30 ft., two 25 ft. and seven 20 ft. spans, besides several 10 ft. iron or steel bridges, and about 900 ft. of iron trestle in bridge approaches. F. W. Cram, of Bangor, is General Manager and Moses Burpee, of Houlton, is Chief Engineer.

Bayfield, Lake Shore & Western.—This company is awaiting the result of the election on the question of issuing \$50,000 of bonds to aid in construction. The election will be held on April 4 and, if the result is favorable, contracts for the first 20 miles, from Bayfield, Wis., which has been definitely located, will be let at once. The preliminary survey extends to the junction of the Duluth, South Shore & Atlantic and the Northern Pacific at Iron River, Wis., a total distance of 45 miles, and was made under G. W. Willis, C. E., of Minneapolis, Minn.

Burlington & Missouri River.—Kilpatrick Bros. & Collins, of Beatrice, Neb., are reported to have received a new contract for grading on the extension of this road in Northern Wyoming. The new work is northwest of the Powder River, 70 miles, the terminus being at Five Mile Creek, north of Sheridan, Wyo., the south border of the

Crow Indian Reservation. Over 2,000 men are reported to be employed on the line west of Gillette, and a large amount of construction material is being received, over 3,500 carloads of ties and rails having been delivered.

California Midland.—The company has been organized to construct a road from Sacramento through the counties of Sacramento, San Joaquin, Merced, Fresno, Tulare and Kern to Bakersfield, and also to construct branches from the main line to Lathrop, Modesto, Stockton and Antioch.

Canadian Pacific.—General Superintendent Abbott, of the Pacific Division, speaking of the outlook for railroad construction in the Kootenay Country, says that Engineer Stewart, with a party of surveyors, has recently left Revelstoke, B. C., on an exploring expedition to the head of Arrow Lake. The company contemplates building a branch south from Revelstoke, and it is likely the work will be done this year. The line would be but 28 miles in length and would be the means of keeping up connection with Kootenay 10 months in the year if not the entire 12.

Through trains will be run by this company, beginning this week, from Vancouver, B. C., to Seattle, an agreement having recently been concluded with the Great Northern giving the company trackage rights over the Seattle & Montana, controlled by the latter company. Trains will use the Mission branch from Mission about 10 miles east of Vancouver south to Sumas; then run over the Bellingham Bay & British Columbia road to New Whatcom, and thence over the Seattle & Montana to Seattle.

Carnelle, Tallahassee & Gulf.—J. H. Davidson & Co., Thomasville, Ga., have resumed the construction work on this road near Tallahassee, Fla., under the contract recently awarded to them. The contract is said to require the completion of the road to the Sopchoppy River by May 1, including the bridges over the Ocklocknee and Sopchoppy rivers. The surveys have been made as far north as Thomasville, Ga., and the line may reach Tallahassee this year. A. Orr, Symington is General Manager and John M. Cook is Chief Engineer.

Chicago, Greenville & Southern.—Col. L. S. Olmstead, an engineer of the Jacksonville South-eastern Line, began surveys last week at Durley for this recently incorporated road. The survey is to be made from a connection with the Jacksonville Southeastern south through Greenville, Ill., and thence through Bond County to Carlyle, in Clinton County, a distance of about 25 miles. The construction of the line to Greenville will probably be commenced as soon as the survey is completed.

Chicago, Milwaukee & St. Paul.—Arrangements are being made for extending the Whetstone branch, through the Sisseton reservation, from the present terminus at Wilmot, S. Dak., 17 miles northwest of Milbank, on the Hastings & Dakota division.

Chicago & Northwestern.—The improvements which will be undertaken this summer on the lines in Iowa are said to include expensive relocation work of the main line to Council Bluffs. Near Jefferson, Ia., where the road crosses the Coon River, the bridge will be raised 30 ft., the grades reduced, and the line shortened nearly a mile. At the crossing of the Des Moines River it is contemplated to raise the bridge or build a new structure on a higher level, and the road between Boone and Moines, the first station west, will be shortened about two miles.

Denver & El Paso Independent.—This is the correct title of the company chartered in Colorado last week, and which has been organized to build the railroad proposed at a recent convention of delegates from El Paso, Las Vegas and other Southwestern towns. The directors will meet at Denver, April 4, for the purpose of electing officers, and when the organization of the company has been completed it is proposed to form a construction company to undertake the actual work of construction. A preliminary survey has already been made for the road from Trinidad southwest through the Maxwell land grant in northern New Mexico, and through the towns of Las Vegas and White Oaks to El Paso, Tex., a distance of 400 miles. The survey shows easy grades along the entire line, with no very difficult engineering work. The principal directors are ex-Gov. E. C. Evans, of Denver, and J. Reynolds, of Las Vegas, N. Mex.

Duluth, Messabe & Northern.—The survey has been completed for the branch running to the Biwabik mine. The length is 16 miles, and the highest grade is 20 ft. to the mile against traffic and 24 ft. with traffic. The branch passes through rough territory, and there will be considerable bridge work. This road will also run into the Cincinnati and Hale mines and into the town of Merritt Minn. Five parties of engineers are cross sectioning along the line from Stony Brook to the Mountain Iron mine, and when work is actually commenced a record for fast grading will be made. As soon as the weather settles the contractors, Donald Grant and Foley Bros. & Guthrie, the contractors, will begin construction to the Missabe iron range.

Duluth, Mississippi River & Northern.—The charter of this company was filed in Minnesota last week by A. W. Wright, of Alma, Mich., and other directors of the Duluth & Winnipeg. The new road will be about 36 miles long, and will extend from a point on the Duluth & Winnipeg east of La Prairie, Minn., on Swan River, toward the Messabe iron range, in northern Minnesota. The contract has been let to Donald Grant and Foley Bros. & Guthrie, of St. Paul.

Duluth & Winnipeg.—Work on the bridge across the St. Louis River near Superior is being pushed, and the structure will be completed within 90 days. Preparations are being made for the construction of ore docks on Alloues Bay. It is the intention to commence running trains into Superior, Wis., on July 1.

East Louisiana.—A force of about 200 men is working on the new branch to Mandeville, La., and the tracklaying will soon begin, the grading having been completed for several miles. The new line begins from a point between Abita Springs and Pearl River and the distance to Mandeville is 21 miles. It will probably be ready for operation in May and trains will run between New Orleans and Mandeville, 57 miles.

Elk Mountain.—Orman, Crook & Co., of Pueblo, Col., have been awarded a contract for the grading and tracklaying on this road between Carbondale and Robinson Lake, Col., a distance of about 36 miles. The road follows Rock Creek, and will reach a number of anthracite coal mines in the northern part of the Elk Mountain range. The new line will probably be operated jointly

by the Denver & Rio Grande and Colorado Midland, with which it connects by branches of these roads in Garfield County.

Everett & Monte Cristo.—The company was incorporated in Washington last week by officers of the Everett Land Co. with a capital stock of \$1,800,000. The proposed line is to extend from Snohomish westerly to the mines at Monte Cristo and to Everett near Puget Sound, and the line will be practically an extension of the Snohomish, Skykomish & Spokane, also owned by the Everett Land Co. The contract for the construction of the road to the Monte Cristo mines has been let to Henry & Balch, of Seattle. The location is now being made and will be completed in about three weeks, when the subcontracts for grading will be awarded. The work will be very heavy, especially along the south fork of the Stillaguamish River, where there will be heavy caisson work necessitating the construction of a large number of short bridges and several tunnels, the longest being about 900 ft.

Geneva, Florida & Pensacola.—This company has been recently organized at Geneva, Ala., to build a road about 100 miles long from that point southwest to Pensacola, Fla. About \$30,000 of the capital stock has been subscribed.

Grand Trunk.—An extension of the Lakeside branch of this road is projected by a local company, and it is reported that it has arranged for building the line to Young's Point on Clear Lake, 8 or 10 miles north of the present terminus. The branch is being operated between Peterboro, Ont., and Lakeland, 14 miles.

Great Northern.—H. J. Coykendall, Superintendent of Construction for Shepard, Siems & Co., on the work between Spokane and the summit of the Cascades, states that there are 125 miles of track to be laid before Spokane is reached, but the tracklayers are putting down three miles a day. The track will be laid into Spokane by June, if the bridge at Albany Falls over the Pend d'Oreille River is completed. Between 4,000 and 5,000 men are now working west of Spokane, and the grade will be completed west from Spokane and down the Moses Coulee to the Columbia River by July. The contract for the section of 55 miles up the Columbia River to the Wenatchee River and up that stream to the summit has not yet been sublet. The tunnel at Stevens' Pass will probably not be cut through until the track is laid so that the heavy machinery can be brought up. A switchback will be used while the tunnel is under construction.

Greeley, St. Vrain & Denver.—The party of engineers under T. S. Titcomb, of Denver, which began the survey for this road a few weeks ago have completed that work for over half the distance between Greeley and Idaho Creek, Col., where connection is to be made with the Burlington system. It is reported that more than half the amount needed to build the road between these towns has already been subscribed in Greeley and Weld county, and that the projectors have made an agreement for the operation of the new road by the Burlington & Missouri River.

Helena, Missouri River Valley & Eastern.—Articles of incorporation of the company were filed in Montana last week. The route as outlined in the articles of incorporation is northeasterly from Helena to the Missouri River, thence in an easterly direction to the town of Castle in Meagher County. It is also the purpose to construct several branch lines. The capital stock is placed at \$3,000,000. This is the third railroad company incorporated within two weeks, designed to run from Helena to the Castle mines.

Helena, White Sulphur Springs & Castle.—This is a local company which has been organized at Helena to submit a proposition for building the road from Helena to the Castle mines, now being surveyed. A subsidy of over \$240,000 has been subscribed for the road, and is to be awarded to the company building the line. The charter of the new company was filed in Montana last week. The route as outlined is from Helena to the Missouri River at Stubbs' Ferry, across the Belt Mountain range by way of White's or Confederate Gulch Pass, thence up the valley of Smith River to White Sulphur Springs and by way of the head waters of the south fork of the Smith River to Castle.

Jack-onville & Mayport.—The extension of this road proposed by the new owners of this property, including D. M. Yeomans, J. A. Russell and Horace Scott, of Louisville, is from Arlington to South Jacksonville, Fla. The work is now well under way and the grading is ready for the ties for a third of the distance. It is proposed that trains shall be running between Jacksonville and Mayport by May 10.

Kansas City, Watkins & Gulf.—A 10-year tax was last week voted by the city of Alexandria, La., to complete this road to that town. The tax is estimated to amount to about \$60,000, and the company agrees to complete the work during April. The tracklaying is now completed to within less than 20 miles of Alexandria, but work has been practically suspended for the last few weeks awaiting the outcome of the election.

Kearney & Black Hills.—Townships in Custer and Logan counties, Nebraska, have guaranteed this company a considerable subsidy for an extension to Gandy, in the latter county. The proposed extension would be about 30 miles long, beginning at Callaway, the present terminus, and extending along the South Loup River to Arnold, and thence west to Gandy.

Lake Shore & Michigan Southern.—The local papers announce that a survey is being made for a line from West Hamburg northeast to Lancaster, N. Y. The line will be about 15 miles long, and connect with the New York Central & Hudson River about 10 miles east of Buffalo.

Lehigh Valley.—A report is printed in local papers that work on the Jersey City, Newark & Western, from Roselle to Jersey City, will probably soon be abandoned. The long trestle across Newark Bay is now the most important work remaining to be completed. On April 3 the company will begin running its New York passenger trains over the tracks of the Central of New Jersey into the Jersey City station. These trains have heretofore been run over the Pennsylvania tracks from Metuchen, about 25 miles west of Jersey City. A connecting track has been laid near Waverly, N. J., from the Lehigh Valley line to the Newark branch of the Central of New Jersey at Brills, two miles east of Newark.

Lynchburg Belt.—R. J. McGrann has been awarded the contract for building that portion of the Belt road connecting the Norfolk & Western with the Lynchburg & Durham Railroad. The line will be about 1½ miles in length, with several trestles.

Mexican Roads.—The Mexican Government has granted Defino Sanchez and others a railroad concession from Isucar de Matamoros to Acapulco. Work must be begun as soon as the Secretary of Public Works approves the plans, and 40 kilometres must be built by June 30, 1913, and 90 kilometres each by two years. The government will pay a subsidy of eight per cent. annually on \$30,000 per kilometre built for 15 years.

Minneapolis & St. Louis.—The second track which the Receiver has recently been authorized to construct will extend from Kenwood, a suburb of Minneapolis, to Hopkins, a distance of five miles. The last named point is where the Pacific division branches from the main line. Owing to the large amount of business thrown over the present single track between Kenwood and Hopkins, and consequent delays to trains and risk of accidents, it has been found necessary to provide this additional track. The contracts for grading have not been let yet, but will be awarded before April 10. The work is not heavy, for the maximum grade is not over 40 ft. to the mile, and the extreme of curvature three degrees, with no bridges of any consequence. This additional track will greatly facilitate the handling of the large and growing passenger traffic between Minneapolis and Lake Minnetonka.

Montana Central.—Work has been resumed on the short branch at Butte, Mont., which is being built to connect with the smelting works about two miles from that town. The grading was suspended in January on account of labor troubles between the contractors, Foley Bros. & Guthrie, and the labor unions of Butte.

The trouble relating to the right of way in Nehart, Mont., for the Belt Mountain branch, which was built last year from Great Falls, is reported to have been settled, and the company will now complete the work in that town. These difficulties forced the company to suspend the operation of the line a few weeks ago, but trains are now running again on the branch.

Navesink.—Burke & Co., of Scranton, and Cofrode & Saylor, of Jersey City, the contractors for building this branch of the Central of New Jersey, are pushing the work on the road, which is to extend from Atlantic Highlands to Highland Beach, N. J., a distance of four and a half miles. The double track is to be ready for operation by the opening of the summer season.

Nelson & Fort Sheppard.—The projectors of this line have asked the provincial government of British Columbia for a land grant amounting to 10,000 acres for each mile of road built by the company. The directors have voted to begin the construction of the line at Nelson as soon as the land grant is authorized. It is proposed to build from Nelson southwest to Fort Sheppard, B. C., a distance of 66 miles.

New Roads.—The railroad between Genesee and Retsof, N. Y., noted last week, is projected by members of the Board of Trade of Genesee, and is not to be built by the Retsof Mining Co., as reported. That company will only be interested, probably, as a stockholder. A preliminary survey was made by one of the engineers of the company under the direction of C. W. Fielder, of Genesee, and other members of the board of trade.

James M. Foster, one of the officers of Caddo Parish, La., is reported to have been authorized to invite proposals for the construction of a railroad west of the Red River from Shreveport north to Texarkana, Ark., to the terminus of a railroad already built from Texarkana to the Sulphur River.

The Board of Trade, of Huntingdon, Pa., has decided to make a survey for a road from Huntingdon northwest to Northumberland, Pa., on the Susquehanna River. The survey will be made by J. M. Africa. The line will be about 70 miles long and is comparatively easy to construct, as it will follow a valley for most of the way, connecting with the Philadelphia & Reading at Winfield, a few miles above Sunbury. The Huntingdon Board of Trade proposes to raise about \$200,000 by subscription for the road. The Philadelphia & Reading will then be asked to construct the road.

James B. Arthur, of Fort Collins, Col., reports the organization of a company at Fort Collins and Longmont, to connect a number of towns in northern Colorado and build to Laramie City, Wyo. The route will be 85 miles long, and the estimated cost of construction is about \$20,000 a mile. The line will begin at Longmont and extend to Loveland and Fort Collins, the distance to that point being 30 miles. The route beyond Fort Collins will be via La Porte and Virginia Dale, crossing the Union Pacific at Red Buttes, Wyo.

Grading was begun last week on the branch of the Grand Trunk which it is proposed to build from Wingham southwest to Goodrich, Ont., on Lake Huron, a distance of 25 miles.

New York & Boston.—The company was incorporated in New York this week with a capital of \$3,000,000, to build a road from the boundary line between New York state and Connecticut, in Rye, Westchester County, to the shore of Long Island Sound, in the town of Westchester, a distance of 20 miles.

Norfolk & Western.—The Cripple Creek branch, which is now in operation between Pulaski and Ivanhoe, Va., will probably be extended this year to the furnaces at Speedwell in Wythe County, Virginia. A considerable part of the grading was finished a year ago when the branch was being built to Ivanhoe. The extension will open up extensive iron deposits in the Cripple Creek region, and the company expects to complete the line in a few months.

Northern Pacific.—The citizens of Colfax, Wash., are arranging to raise a bonus to induce this road to build a branch into that place.

North St. Paul Motor Line.—The Northwestern Thomson Houston Co. have the contract for constructing and equipping a six mile extension to the White Bear Lake. The line already constructed will be changed to be operated by electricity.

Oregon Short Line & Utah Northern.—It is reported that a change in the location of the line between Dillon and Camas, Idaho, is likely to be made this year so as to avoid the route through the Beaver Creek Canon. It is said that the new route will leave Dry Creek Station, and extend through Medicine Lodge Canon and down the Red Rock River to Dell station. This would considerably reduce the grades as against those of the present line, and also avoid the snow blockades which occur in the Beaver Creek Canon.

Philadelphia & Bustleton.—Surveys are reported to have already begun for this branch of the Pennsylvania road, to Bustleton, a suburb of Philadelphia. The new line, in connection with the short branch from Holmesburg Junction to Bustleton, will form a loop line for suburban passenger traffic. The route of the new

road is said to be from the intersection of Hart lane with the New York division northward through Cedar Grove, Olney, Volunteeertown, Oxford, Church and Pennypack, all small settlements, to Bustleton, bringing that town three miles nearer to Broad street station than it now is. As soon as the complete surveys can be made and the necessary ordinances passed, it is expected to begin work and to have the road finished this year. As an offset to these statements, one of the officers of the Pennsylvania insists that the surveys are not being made by that company.

Philadelphia & Reading.—The plans for the several suburban lines recently incorporated to build to the towns north of Philadelphia, are rapidly maturing, and probably contracts will soon be given out. The right-of-way problem is a difficult one, and as the lines will extend through a populous country, grade crossings must be avoided. The two most important lines are the Philadelphia & Newtown Connecting and the Philadelphia & Frankford. The Philadelphia Council last week passed an ordinance to allow the Newtown Connecting line to build its road in the Twenty-second Ward, in order to connect with the Twelfth Street Terminal system in the city. Part of the Frankford line must be elevated through the town, and an ordinance will soon be asked authorizing this work. Both lines are to be finished at about the same time as the Terminal system in Philadelphia.

Pittsburgh, Shenango & Lake Erie.—The extension to Conneaut Harbor on Lake Erie has been completed with the exception of the last three miles and will probably be in operation by July. The extension has been under construction since last fall and is about 10 miles long, extending northwest from the main line at Conneaut Junction north of Albion. The extension will give the company a good harbor on Lake Erie for its coal trade. A close traffic agreement has also recently been made for an interchange of traffic with the Pittsburgh & Western at Butler, Pa., the southern terminus.

Plymouth County.—The company has secured a special charter from the Massachusetts Legislature to build a line in the northern part of Plymouth County, from East Weymouth, to a point in Hingham, Mass., on the Central Division of the Old Colony. The capital stock of the company is \$250,000, with the privilege of increasing it to \$500,000.

Portland & Pacific.—The company was incorporated in Oregon last week. It is proposed to build a road from Portland to a point on the Pacific Coast, in Clatsop County. The principal office is to be at Portland, and the capital stock is placed at \$1,500,000.

Quebec & Lake St. John.—Several contracts have been let for the northern extension of the road, and the work is now being pushed with vigor. A contract has recently been signed for 15 miles of the work, and 10 miles additional will soon be let for the line between Metabetchouan and Chicoutimi, Que. The extension may reach Riviere au Sable in November.

Richmond, Nicholasville, & Beattyville.—John M. McLeod, of Louisville, Receiver of the road, has been authorized by the United States Circuit Court to make a new survey and estimate of the cost of extending the road from its present terminus at Irvine east along the Kentucky River to Beattyville, Ky.

Richmond & Rocky Comfort.—The survey from Kellar is now within a few miles of Richmond and will reach Rocky Comfort, Ark., by April 15. The line is to be about 20 miles long through the timberlands near the Red River in Little River County. M. A. Locke is President of the company.

Rio Grande Southern.—The line from Hesperus, Col., to the coal mines about three miles from that town has been located, and is now under construction. The contractors are Leary & Moore, of Walsenburg, Col. Another branch is proposed from the same town to the Porter Coal Mines, and work will be commenced soon, the line being a little less than a mile long.

A party of about 15 surveyors are now engaged beyond of Mancos Station, about 45 miles north of Durango, surveying the proposed extension southwest in the direction of the San Juan River. The object is to find the most practicable route for a road to the San Juan River and thence along the river to a connection with the Atlantic & Pacific in Northern New Mexico.

Rochester & Honeoye Valley.—The construction work on this branch is now completed from Rushville, where it connects with the Buffalo & Geneva, north to Rochester, N. Y., with the exception of about two miles, where the track has not yet been laid. The work is not being actively pushed at present, but the road will be completed some time before the main line of the Buffalo & Geneva.

San Luis & San Joaquin.—The executive committee which was chosen at the recent convention, at Bakersfield, Cal., of delegates from the San Luis and San Joaquin Valleys, and is to have charge of the construction of the line, met at San Francisco last week, to arrange for the preliminary work. A survey has been made between Port Harford, on the Pacific coast, and Bakersfield, Cal., in the San Joaquin Valley, but the committee ordered a new survey to be made across the mountains. The committee is trying to raise enough funds along the line to build the road as a local enterprise. Several financial plans have been proposed. One would assess landowners along the route \$1 for each acre of land owned, but the counties will probably be asked to subscribe for the stock of the road if this can be done legally, which is doubted. The main line is from Port Harford through Cayucos, Paso Robles, Shandon, and via Polonio Pass to Bakersfield, 150 miles. The Fresno branch is to be via Leomere and the west side of Tulare Lake, and another branch will connect Visalia and Tulare, on the east side of Tulare Lake. The general work will be easy, with maximum grades of two per cent, and maximum curves of 10 degrees. The iron bridge across Salinas River will be 700 ft. long and three 1,000-ft. tunnels will be necessary. W. M. O'Shaughnessy, of San Francisco, is Chief Engineer.

St. John's River & Gulf.—The company has been chartered in Florida, the incorporators including a number of Eastern residents. The projectors intend building a road from near Albion to the St. John's river near Green Cove Springs, with a branch to Jacksonville, the length of the road to be about 100 miles. The capital stock is \$500,000.

St. Paul & Duluth.—The extension of the Cloquet branch to the Mesaba iron range is reported to have been decided upon. The branch now extends from Northern Pacific Junction northwest to Cloquet, and it

is the intention of the company to begin work on the extension this spring.

Sioux City, Chicago & Baltimore.—L. F. Wakefield, of Sioux City, began the preliminary survey last week for this road east of Sioux City, and several lines are to be run at present to the eastern end of Woodbury County. About \$25,000 of the capital stock was subscribed in Sioux City last week before the company was fully organized. The city will be asked to vote a subsidy of about \$300,000, but the projectors state that this matter has not yet been definitely decided.

Spokane & Northern.—President D. C. Corbin states that any work on the extension beyond the present terminus depends altogether upon the actions of the British Columbia and Dominion Parliament on the charters he has applied for. The commencement of work also depends on the opening of the Okonogan Indian Reservation. It is likely that the line will be extended from the Little Dalles north to the boundary line this year, if the provincial government of British Columbia acts favorably on the Nelson & Fort Shepherd charter, now under consideration. "If the concessions are granted," said President Corbin, "I expect to extend the line to Kootenai lake inside of 18 months."

Tennessee Central.—The extension of this line to the coal and iron mines in Cumberland County will probably be undertaken this summer. A large sum has been subscribed to build the extension from Jewett north to Crossville, Tenn., a distance of 10 miles. The road is now in operation for 13 miles from Spring City on the Cincinnati Southern. Charles Clinton, of Spring City, is General Manager.

Tennessee & Coosa Valley.—A. N. Nichols is reported to have the contract to complete this road to Guntersville, Ala., northwest from Gadsden, and is preparing to begin the construction. The road is now owned by the Nashville, Chattanooga & St. Louis.

Union Pacific.—A survey was begun last week by William Ashton for a branch about seven miles long to the Acme Coal Company's mines near Trinidad, Col. The new branch will begin at Victor Junction, about 12 miles from Trinidad, and will be an extension of the Chicosa branch.

Watertown, Sioux City & Duluth.—An engineering party began the survey for this road a few days ago, but have been compelled to give up the work because they were not allowed to cross the Indian reservation north of Watertown, S. D. The work cannot be resumed until April 15, when the reservation will be opened for settlement.

Winona & Southwestern.—It has been decided to build from Osage, the present terminus, to Mason City, Ia., a distance of 25 miles, to connect with the Mason City & Fort Dodge. The right of way has been secured through Mitchell and Cerro Gordo counties.

GENERAL RAILROAD NEWS.

Canadian Pacific.—The earnings and expenses of the road for February and two months were:

Month of February.	1892.	1891.	Inc.
Gross earnings.....	\$1,456,369	\$1,338,494	\$117,875
Oper. expenses.....	1,034,239	1,001,674	32,565
Net earnings.....	\$402,160	\$336,820	\$65,340
Jan. 1 to March 1.			
Gross earnings.....	\$3,065,471	\$2,703,715	\$361,756
Oper. expenses.....	2,131,160	2,037,170	93,990
Net earnings.....	\$934,311	\$666,545	\$267,766

Central of Georgia.—The receivership case came up in the United States Circuit Court at Macon, Ga., last week on the motion for an order making permanent the recent appointment of a receiver. The arguments were begun on Thursday and were continued for several days, the motion being opposed by the company, the Richmond & West Point Terminal taking no part in the suit. On Tuesday an order was issued appointing the directors of the company Receivers for the property and enjoining the Richmond Terminal from voting the 42,000 shares held by that company, which is a majority of the stock. This stock is held as collateral for the present issue of Richmond Terminal five per cent. bonds. The Judge's order of injunction has however one conditional clause. It says the majority of stock shall be enjoined "if held by a competing line or interest." The officers of the Richmond Terminal say that the effect of the order is to leave open the question whether the Richmond Terminal is a competing interest.

Chesapeake & Nashville.—An order for the sale of the road was issued in the United States Circuit Court in Louisville, Ky., last week, and H. M. Drake, of Nashville, was appointed Special Master to effect the sale. The order was made in the suit brought against the company by the Mississippi Valley Construction Co. The road extends from Gallatin to Scottville, Tenn., 35 miles.

Chesapeake & Ohio.—The earnings for February were as follows:

	1892.	1891.	Inc.
Gross earnings.....	\$705,134	\$623,073	\$82,061
Oper. expenses.....	529,248	466,101	63,147
Net earnings.....	\$175,886	\$156,972	\$18,914
Eight months, July 1 to March 1:			
Gross earnings.....	\$6,210,909	\$5,389,405	\$821,495
Oper. expenses.....	4,576,916	3,927,734	649,182
Net earnings.....	\$1,633,993	\$1,461,671	\$172,322

Chicago, Burlington & Quincy.—The statement of earnings for February makes one of the best showings in the history of the company, though for a short month, and shows the result of the movement of a large corn crop. The freight earnings for the month were about 50 per cent. larger than 1891 and the gross receipts record a gain of \$830,000 over last year. For two months the surplus is \$402,000, compared with a deficit of \$368,000 in like months of 1891. The total net gain for the two months is more than 1 per cent. on the stock. The expenses for February were 64.7 per cent. of the gross as against 72.8 per cent. last year. The statement is as below:

Month of February:	1892.	1891.	Inc.
Passenger.....	\$606,754	\$533,011	\$63,743
Freight.....	2,138,985	1,424,631	714,354
Miscellaneous.....	302,617	275,230	27,387
Total.....	\$3,048,356	\$2,232,872	\$815,484
Oper. expenses.....	1,630,381	1,353,115	277,266
Balance.....	\$1,417,975	\$879,757	\$538,218
Fixed charges.....	10,090	795,186	14,814
Net earn.....	\$272,886	Def. \$187,666	\$460,552

Two months, Jan. 1 to Feb. 28.	1892.	1891.	Inc.
Passenger.....	\$1,220,857	\$1,150,781	\$70,076
Freight.....	4,239,284	2,852,832	1,386,452
Miscellaneous.....	617,043	561,121	55,922
Total.....	\$6,077,184	\$4,564,734	\$1,512,450
Oper. expenses.....	4,054,710	3,315,465	739,245
Balance.....	\$2,022,474	\$1,249,269	\$773,205
Fixed charges.....	1,620,000	1,590,372	29,628
Net earnings.....	\$402,474	Def. \$368,103	\$770,577

Chicago, St. Paul, Minneapolis & Omaha.—The annual report for the year ending Dec. 31 shows the following results:

	1891.	1890.	Inc.
Gross earnings.....	\$3,021,312	\$2,812,320	\$208,992
Operating expenses.....	3,446,111	4,785,568	1,339,457
Net earnings.....	\$2,575,197	\$1,026,762	\$1,548,435
All charges.....	1,452,820	1,372,950	79,870
Balance.....	\$1,122,377	\$653,812	\$468,565
Dividends.....	562,840	450,272	112,568
Surplus.....	\$559,537	\$203,540	\$355,997

The income from land sales was \$468,728 and \$450,715 in 1890. The mileage in the year increased 87 miles, the total mileage being now 1,481. The funded debt increased \$745,576, for new road and the Sault St. Marie & Southwestern. Passenger earnings increased 16.09 per cent., and the rate per mile was 2.51 cents against 2.45 cents. Freight earnings increased 18.1 per cent., and the rate per mile was 1.12 cents against 1.01 cents in 1890. The expenditures for construction and equipment were \$308,911.

Great Northern.—The company has announced that its stockholders of record on April 25 will have the right to subscribe pro rata to an issue of \$15,000,000 ten-year collateral trust bonds at 7½%, secured by an equal amount of four per cent. first mortgage gold bonds of the St. Paul, Minneapolis & Manitoba Company, issued upon its Pacific extension. The bonds will be used to provide funds for the extension to the Pacific coast.

New York, Lake Erie & Western.—The following statement gives the earnings for February and since October, as compared with the same periods in the previous year:

	1892.	1891.	Inc. or dec.
Gross earnings.....	\$2,278,623	\$2,054,403	\$224,220
Oper. expenses.....	1,619,856	1,366,261	253,595
Less proportion due leased lines.....	\$638,797	\$688,142	D. \$49,345
Net earnings.....	\$451,729	\$178,903	I. \$272,826
Five months, October 1 to arch 1:			
Gross earnings.....	\$12,664,924	\$11,831,479	I. \$833,445
Oper. expenses.....	8,839,502	7,998,229	I. \$841,273
Less proportion due leased lines.....	\$3,825,422	\$3,833,250	D. 7,828
Net earnings.....	\$1,004,552	\$1,068,493	L. \$63,941
Net earnings.....	\$2,720,870	\$2,764,757	D. \$43,887

New York & New England.—A bill was introduced in the Massachusetts Legislature this week to allow the company to issue new bonds to the extent of one half its capital stock. Similar bills will be submitted to the legislatures of New York, Rhode Island and Connecticut. The amount of bonds to be issued is about \$11,350,000.

New York, Providence & Boston.—The management of this road was assumed this week by the New York, New Haven & Hartford, under a temporary agreement for one year, which must be ratified at the end of that term by a two-thirds vote of the stockholders of each company. The properties secured by the New Haven Company include the New York, Providence & Boston main line between Providence and New London, 62 miles; the Providence & Worcester Division, which is leased under a guaranteed rental of 10 per cent. dividends, and extending from Providence to Worcester, 43 miles. The total mileage acquired, including the branches, is 136 miles, of which 105 miles is double track. The capital stock of the road is \$5,000,000, and of the Providence & Worcester \$3,500,000, the par value being \$8,500,000. The market value of the stock of the former company is 218½%, and of the Providence and Worcester 250, so that the market value of the properties transferred is about \$19,675,000 in stocks alone. It is said that this stock will be merged, share for share, with that of the New Haven road, which is now quoted at 228. Both companies have been paying annual dividends of 10 per cent. for many years. The Providence & Stonington Steamship Co., which has a capital stock of \$1,500,000, a majority of which is controlled by the New York, Providence & Boston Railroad, is also included in the contract. The New Haven road will now control 194 miles of the 232 miles of the shore line between New York and Boston.

Philadelphia & Reading.—The statement of the earnings for the month of February, 1892, as compared with the same month in 1891 is as follows:

	1892.	1891.	Inc. or dec.
Gross receipts.....	\$1,788,774	\$1,470,917	I. \$317,857
Oper. expenses.....	1,025,998	889,424	I. 136,574
Profit in operating.....	\$762,806	\$581,493	I. \$181,313
Other receipts.....	35,997	21,259	I. 14,738
Profit for month.....	\$798,804	\$602,752	I. \$196,052
Expn. for perm. improv.	9,541	51,033	D. 41,492
One-twelfth fixed charges.....	625,000	611,709	I. 13,291
Total.....	\$634,541	\$962,802	D. \$328,261
Surplus.....	\$161,263	Def. \$60,050	I. \$221,313

Pittsburgh, Chartiers & Youghiogheny.—The capital stock has been increased from \$600,000 to \$1,000,000. The stockholders also, at a special meeting at Pittsburgh, March 25, authorized the issue of four per cent. bonds to the amount of \$1,000,000, payable in 40 years. The new issue is to be used to retire part of the present bonds, and the balance will be reserved for future improvements and additions to the property. This road is now controlled by the Pennsylvania, which purchased it a few months ago.

Rio Grande Western.—The company has issued \$2,500,000 of new common stock, stockholders having the right to subscribe pro rata at \$40 per share, the proceeds to be used in the purchase of the Tintic Range Railway, which has just been completed. The road extends from Springville on the Rio Grande Western, 50 miles southwest to Eureka, Utah, and other points in the Tintic mining district. The Rio Grande Western Company expects by this acquisition to add \$200,000 per annum to its net earnings without increasing its fixed charges.

Western Maryland.—The Baltimore & Cumberland Railroad has submitted a proposition, which has been approved and forwarded by the Finance Commissioners of Baltimore to the Mayor and City Council, for the lease of the Western Maryland Railroad. The debt of the latter road to the city is taken at \$5,000,000, and the Baltimore & Cumberland directors offer to pay the city interest at the rate of four per cent. in semi-annual installments of \$100,000; to pay \$50,000 a year toward a sinking fund to pay off the principal, and, in addition, to pay at once the sum of \$500,000 to pay off the floating debt.

TRAFFIC.

Chicago Traffic Matters.

CHICAGO, March 30, 1892.
The regular quarterly meeting of the Advisory Board of the Western Traffic Association has been called for April 12, in this city, but there is apparently little prospect that a quorum can be secured for the meeting. In view of the large number of important questions pending before the Board it is probable that a special meeting will be called to be held in New York as soon after the regular date as possible.

The Commercial Travelers' Federation of America are pressing the various passenger associations to adopt a 5,000-mile interchangeable ticket to be sold at two cents per mile, and promise to assist the roads to restrict its use to legitimate purchasers in case it is adopted. It is hard to see how this can be done unless each ticket bears a photograph of the original purchaser and the roads act in good faith in requiring their conductors to refuse all tickets when not satisfied that they are in the hands of the rightful owner, and even then it is questionable if the inauguration of the interchangeable ticket would not mean a positive reduction to a flat two cent rate for transportation.

Chairman Finley of the Western Passenger Association has rendered a decision in respect to a complaint of the Chicago, Rock Island & Pacific against the Chicago, Burlington & Quincy, charging first, the selling of a ticket through a broker, and second, excessively limiting the same. The first charge was not sustained. The Burlington is found guilty as charged in the second count, and fined the full proportion received on the ticket in question. In a charge made against the Chicago, St. Paul, Minneapolis & Omaha by the Chicago, Burlington & Northern for selling a ticket at an unauthorized rate the complaint is dismissed.

General Passenger Agent Bassett, of the Pittsburgh & Western, has replied to the notice given by the Western roads, that tickets of his company's issue were being used to demoralize rates between Chicago and St. Paul, admitting that the appearance of the tickets purchased of Chicago brokers indicates that they have been altered as to dates. He has ordered the agency closed April 1.

Traffic Notes.

The Illinois Central has given notice at Kansas City that it can take no more grain for export via New Orleans, the elevators at that point being full.

The roads taking pig iron from the Alabama iron district have reduced rates to all northern, eastern and western points, the reduction being about 25 cents a ton to eastern and 15 cents to western points.

The Louisville, New Orleans & Texas road had taken 501,576 bales of cotton to New Orleans during the present crop year up to March 22. This is 33,000 bales more than were delivered during the whole of the last crop year.

The Crescent Oil Co., which has an oil storage plant on the Delaware River south of Philadelphia, has in course of construction a pipe line extending to that point from the McDonald oil fields near McKeesport, Pa., a distance of about 300 miles. The line will be completed in about three months.

The inspection bureau of the Central Traffic Association and of the joint rate committee of the Eastern and Western roads reports that the bureau in the Central Traffic Association territory has secured to the roads a net gain of \$426,203, and at points in the territory of the joint rate committee a gain of \$1,121,468. Whether this was during the last year, or extended over a longer period, does not appear.

The Atchison, Topeka & Santa Fe has notified its connections that they will not be requested to assist in the payment of claims for loss, damage, or overcharge caused by errors or negligence of the employees of the Atchison, and that the Atchison will not participate in similar claims arising through error caused by the employees of other lines.

Coal Rates to Lake Erie Ports.

The railroads running through the Pittsburgh, Ohio, and West Virginia coal fields have agreed upon rates for shipments to the Northwest for the ensuing year. The Pittsburgh operators had complained that their rates were too high for successful competition with the Hocking Valley. The following rates to Lake Erie ports were adopted: Hocking Valley district, 85 cents a ton; Pittsburgh district, 85 cents; West Virginia district, \$1.02½. This is a decrease of 4 cents in the Pittsburgh rate, and an increase of 2½ cents in the West Virginia rate.

Eastbound Freight Shipments.

The shipments of eastbound freight from Chicago by all the lines for the week ending March 26 amounted to 73,578 tons, against 80,640 tons during the preceding week, a decrease of 7,062 tons, and against 82,108 tons during the corresponding week of 1891, a decrease of 1,531 tons. The proportions carried by each road were as follows:

Roads.	Week to Mar. 26		Wk to Mar. 19.	
	Tons.	P. c.	Tons.	P. c.
Michigan Central.....	10,993	15.0	12,820	15.9
Wabash.....	8,407	11.5	12,085	15.0
Lake Shore & Michigan South.....	7,531	10.3	8,755	10.9
Pitts., Ft. Wayne & Chicago.....	7,003	9.5	8,428	10.4
Pitts., Cin., Chicago & St. Louis.....	4,188	5.7	6,727	8.3
Baltimore & Ohio.....	5,622	7.7	4,531	6.0
Chicago & Grand Trunk.....	11,500	15.7	7,950	9.9
New York, Chic. & St. Louis.....	6,198	8.4	5,053	6.3
Chicago & Erie.....	9,391	12.5	11,571	14.3
Other lines.....	2,737	3.7	2,420	3.0
Total.....	73,578	100.0	80,640	100.0

The three Vanderbilt lines together carried 33.7 per cent. while the two Pennsylvania lines carried 15.2 per cent.

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The best results are obtained in freight train braking from having all the cars in a train fitted with power brakes, but several years' experience has proven conclusively that brakes can be successfully and profitably used on freight trains where but a portion of the cars are so equipped. Below is a graphical illustration of the progress made in the application of the Automatic Brake to freight cars since its inception

Year.	No. per year.	Grand total.
1881	105	105
1882	1,085	1,190
1883	4,966	6,156
1884	15,051	21,207
1885	10,410	31,617
1886	8,946	40,563
1887	9,281	49,844
1888	27,696	77,540
1889	26,065	103,605
1890	50,502	154,107
1891	39,061	193,168

193,168 freight cars fitted with the Westinghouse Automatic Brake, which is nearly 20 per cent. of the Entire Freight Car Equipment of this country.

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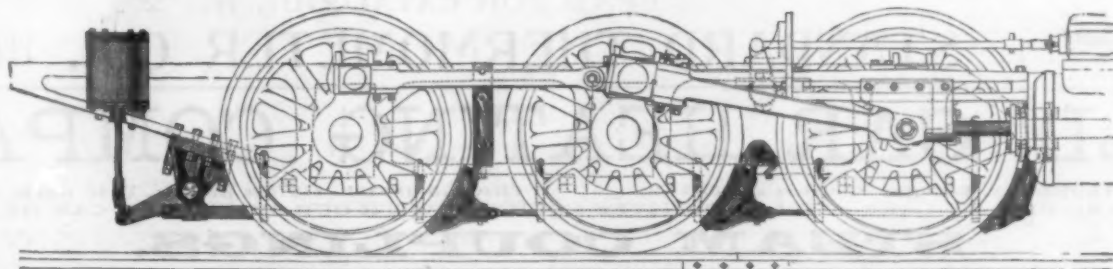
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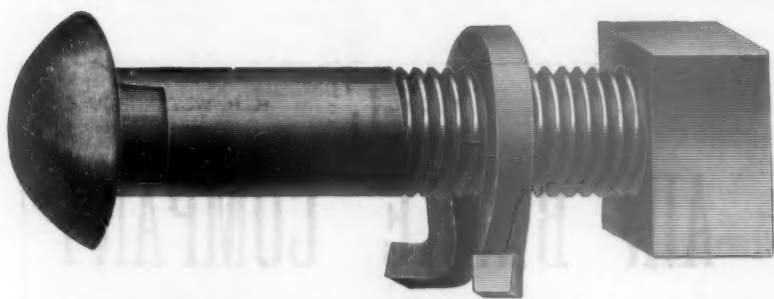
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This nut lock is presented on its merits as the best and cheapest device for securing track joints.

It is a torsional loop made of good quality of tempered spring steel, having horizontally inclined foot pieces, which are curved inward, thereby greatly increasing the spring resistance and acting simultaneously; rests upon the base of angle bar, or underlying rail base in case of fish plate, preventing the loop portion from rotating and hammering down thread of bolt.

The nut lock for $\frac{3}{4}$ bolt made of $\frac{1}{4}$ in. square steel, standard pattern, yields a tension of 1,300 lbs. on the bolt, which is sufficient to reduce the wear of the bearing surfaces of the angle bars on the rails, imparting, as it does, a uniform bearing the entire length of the bar.

The "Standard" Nut Lock has sufficient elasticity to maintain a tight joint, which cannot be truthfully said of many light-weight single coil washers.

The "Standard" Nut Lock is, in its superficial form, similar to an annular coil twisted out of plain, i. e., the curved shoulders or ends of the loop proper are spread in the usual manner of spring coils, at which bearing points the locking friction is equal to that of the best single coil washer, and added to this it is terminated in inwardly curved extensions, which must apparently furnish additional short leverage spring force of a torsional character.

Distinctive Merits of the "Standard" Nut Lock, Condensed:

Fixedness of position—cannot rotate and hammer down threads of bolt.

Cannot get one end into elongated slot of angle-bar.

Unlike any permanently placed, double washer, the Standard is interchangeable regardless of distance between bolts.

Cannot be put on wrong side out, as the outward projection of the foot pieces would prevent the nut being turned up.

Has more spring power directly under the nut than any two ordinary coil nut locks. Being fixed in position, it offers double the locking friction of nut locks, which when in their dead "set" condition turn back with nut by the vibrative effect of passing train.

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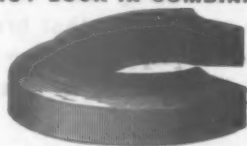


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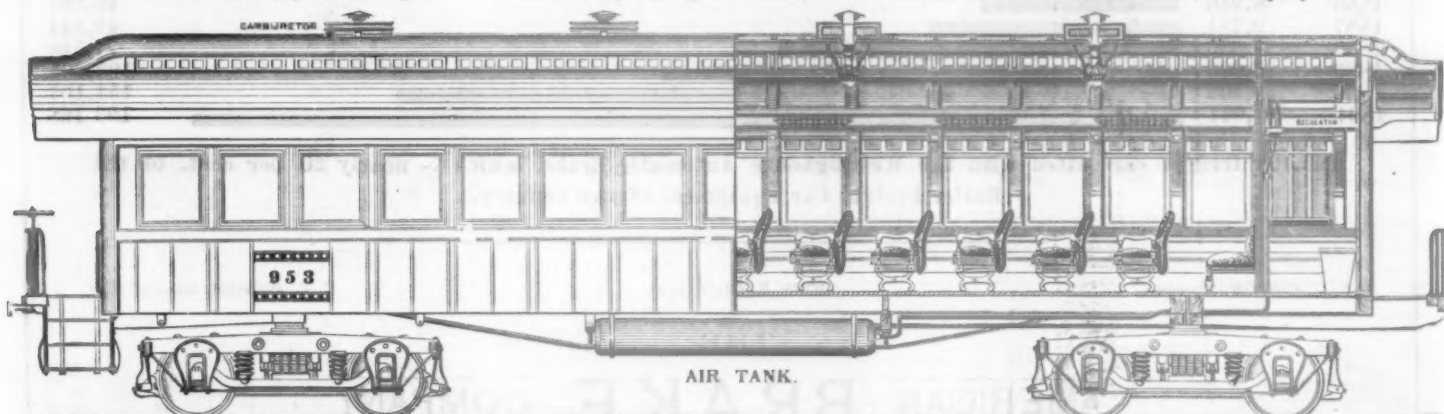
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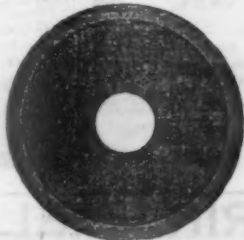
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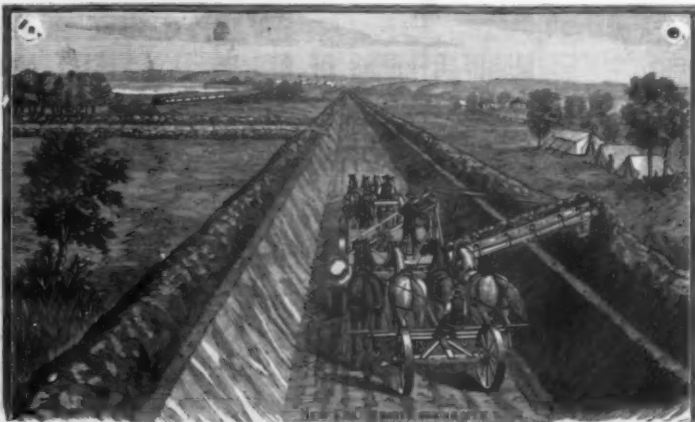
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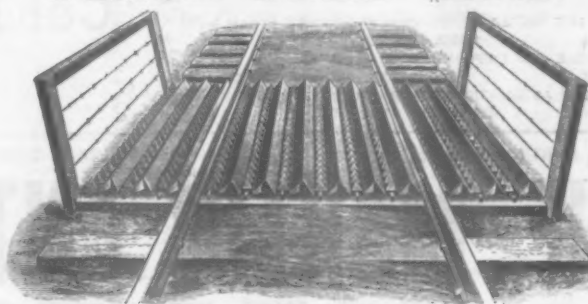


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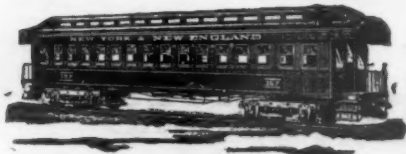
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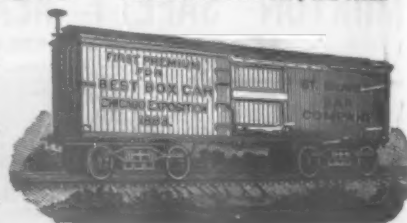
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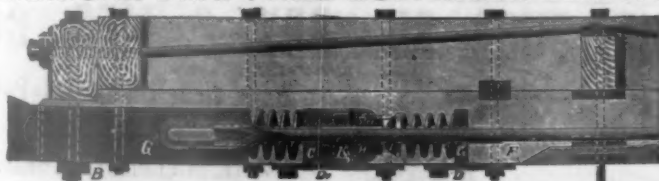
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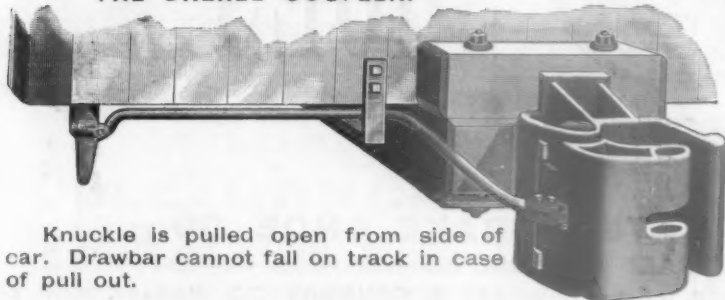
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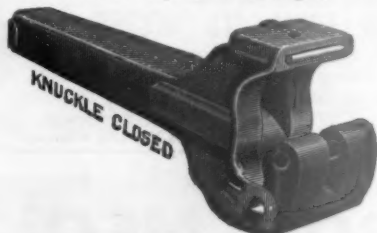
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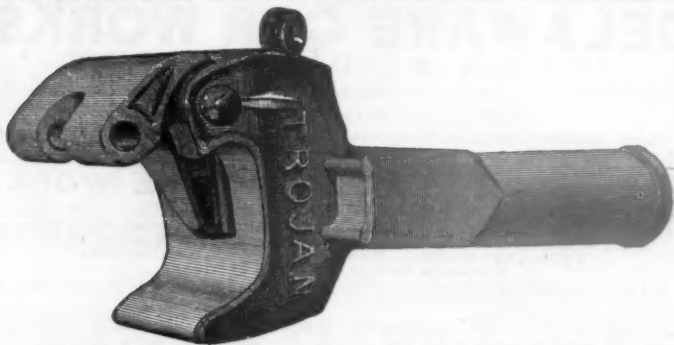
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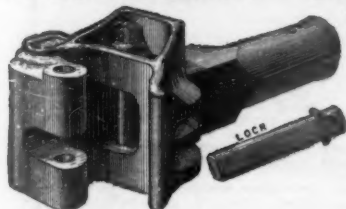
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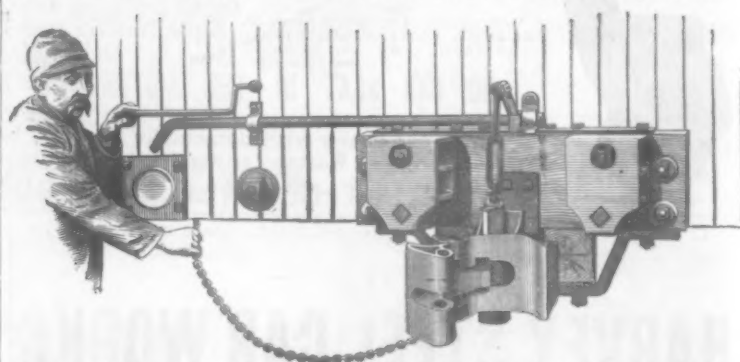
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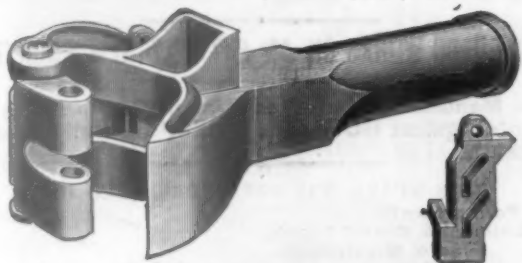
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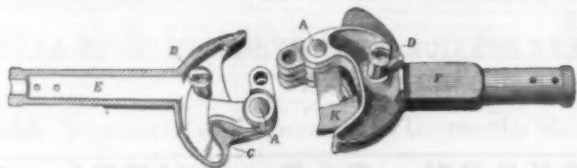


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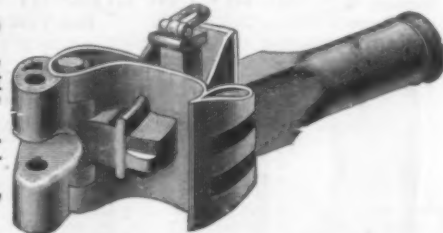
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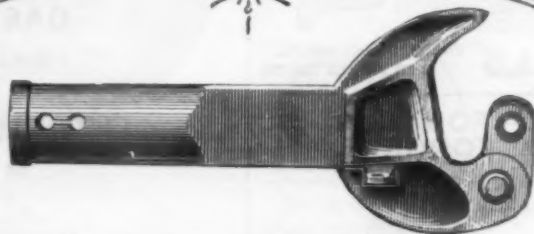
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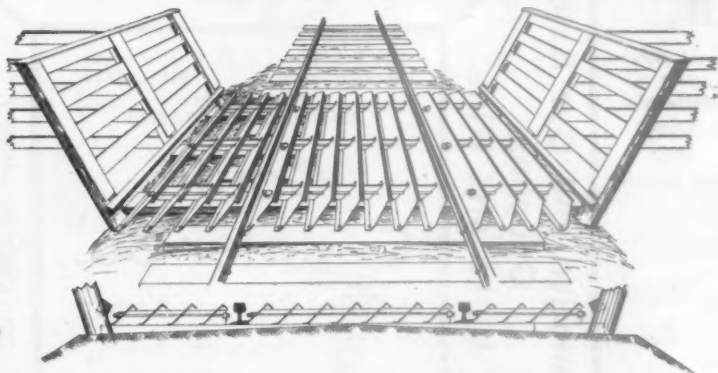
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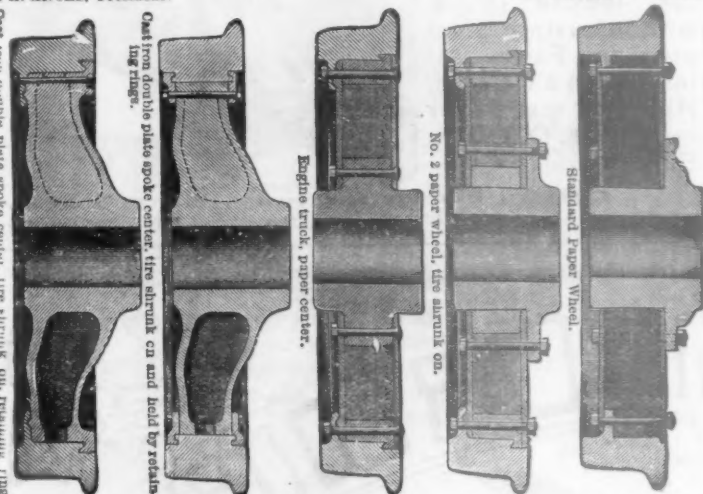
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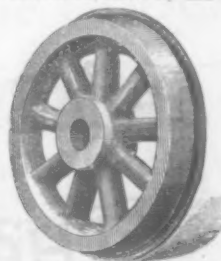
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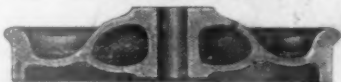
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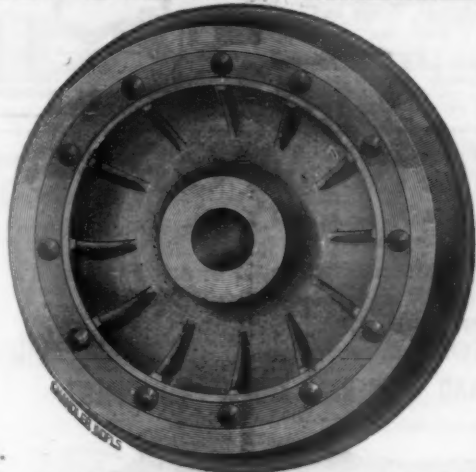
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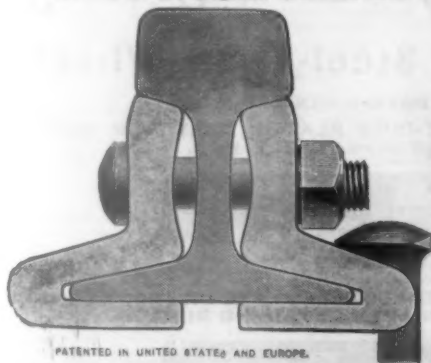
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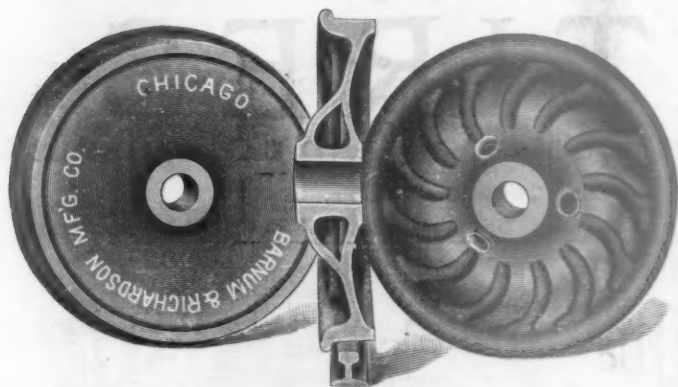
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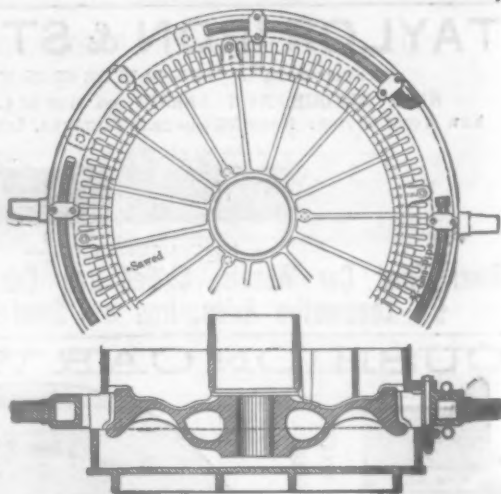
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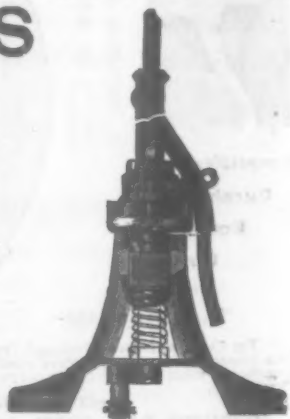
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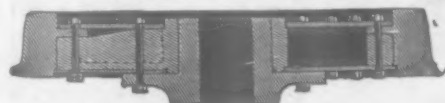
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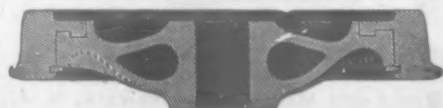
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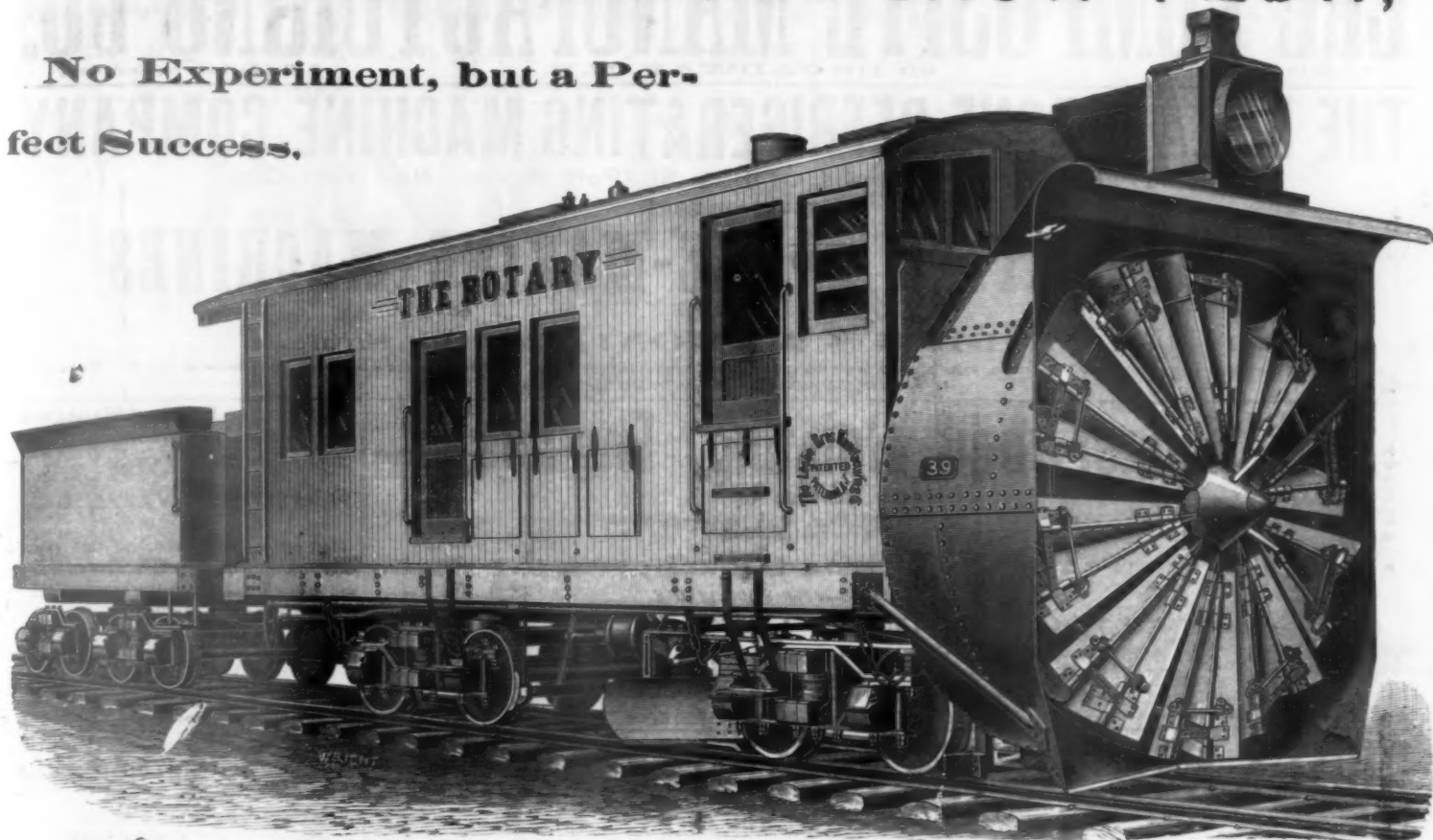


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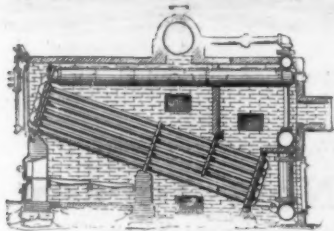
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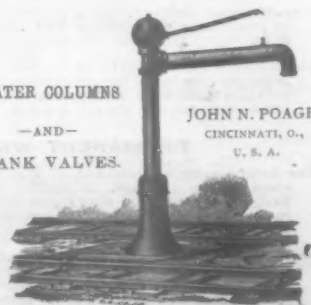
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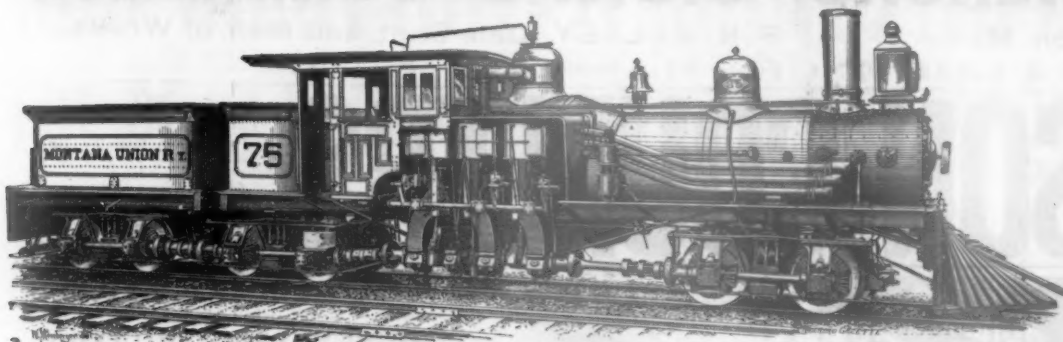
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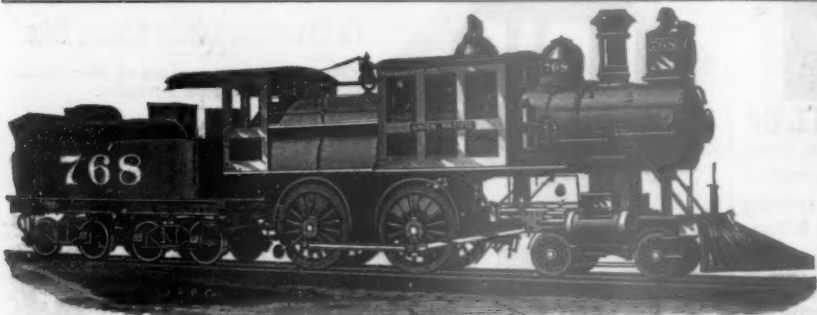
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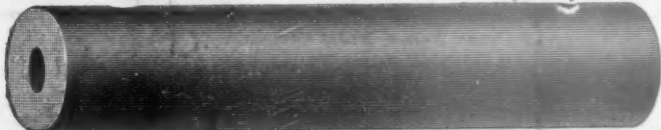
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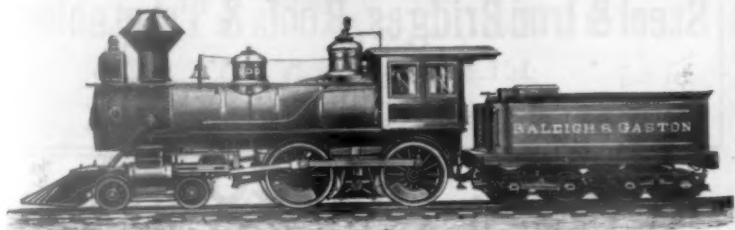
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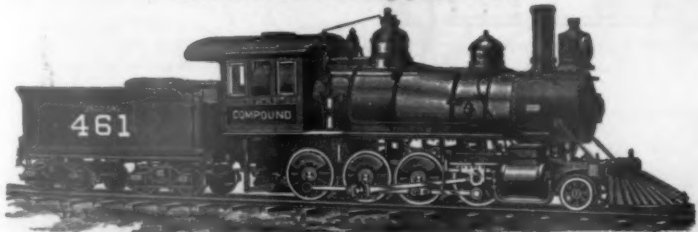
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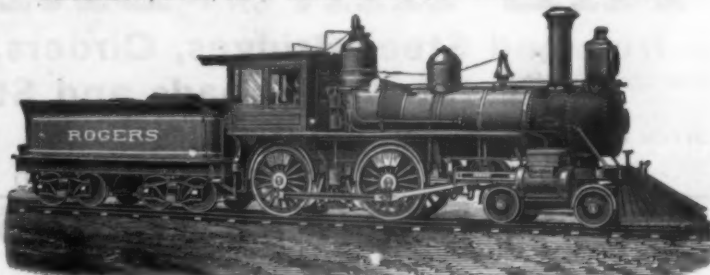
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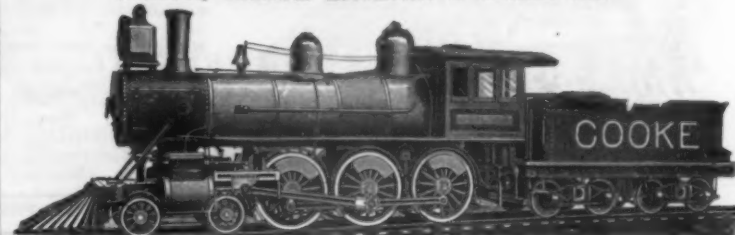
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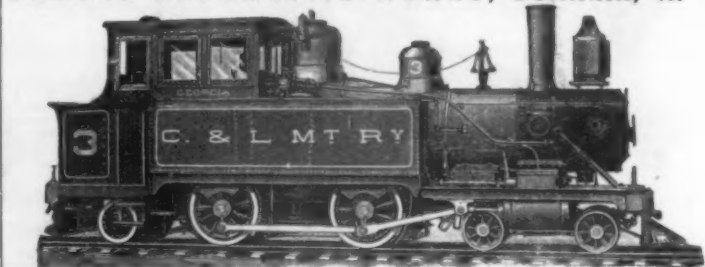
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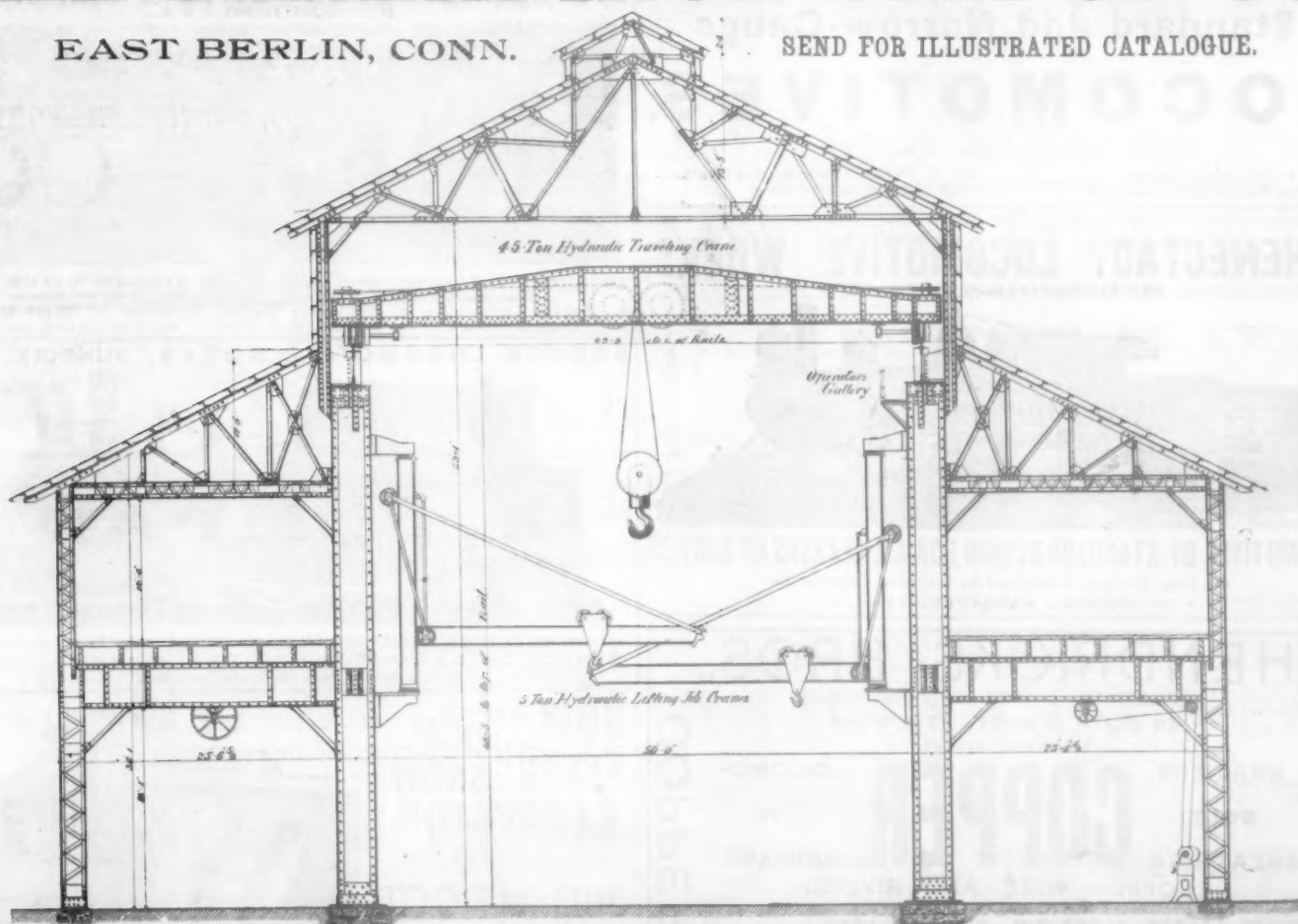
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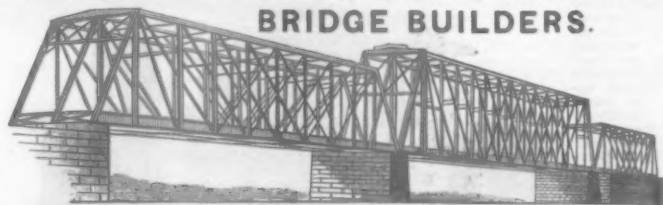


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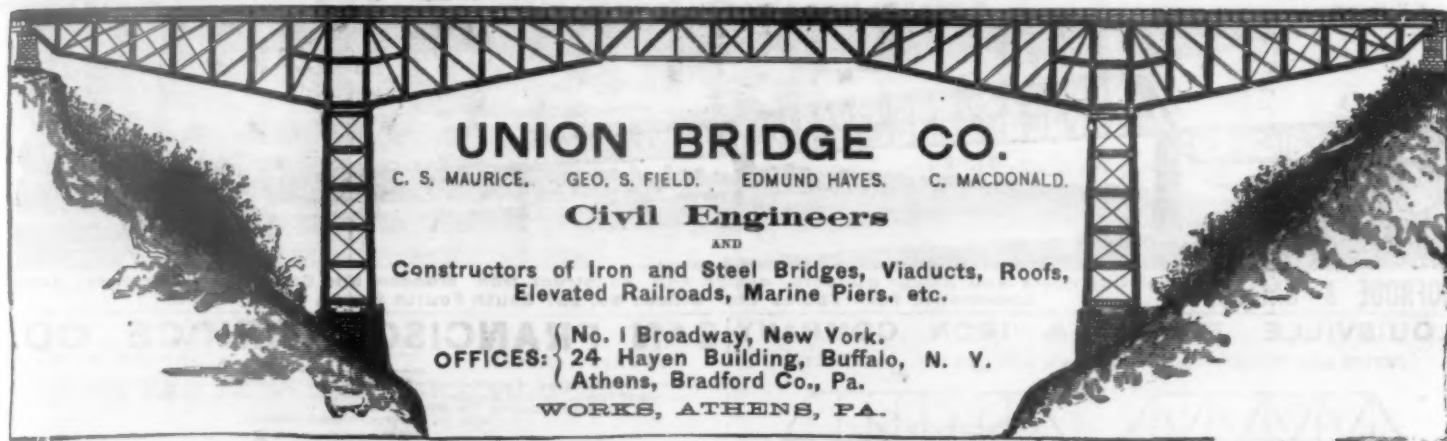
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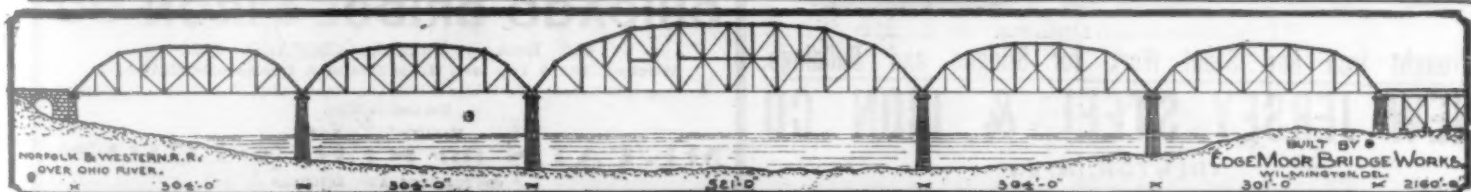



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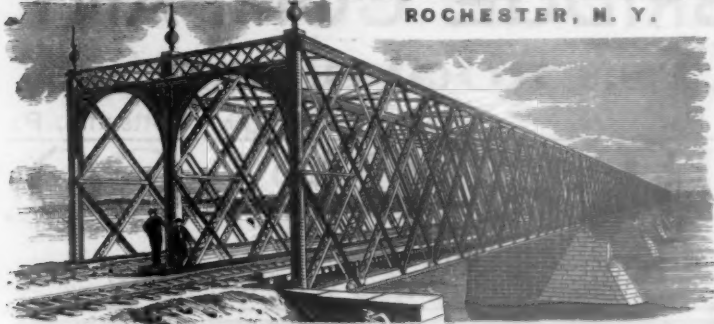
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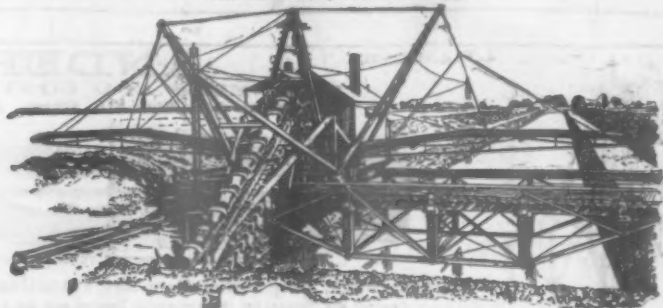
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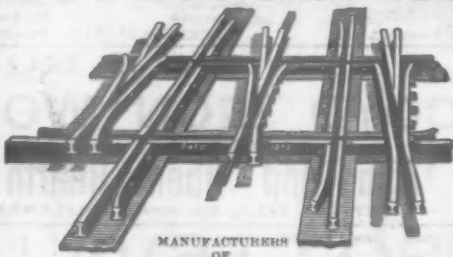
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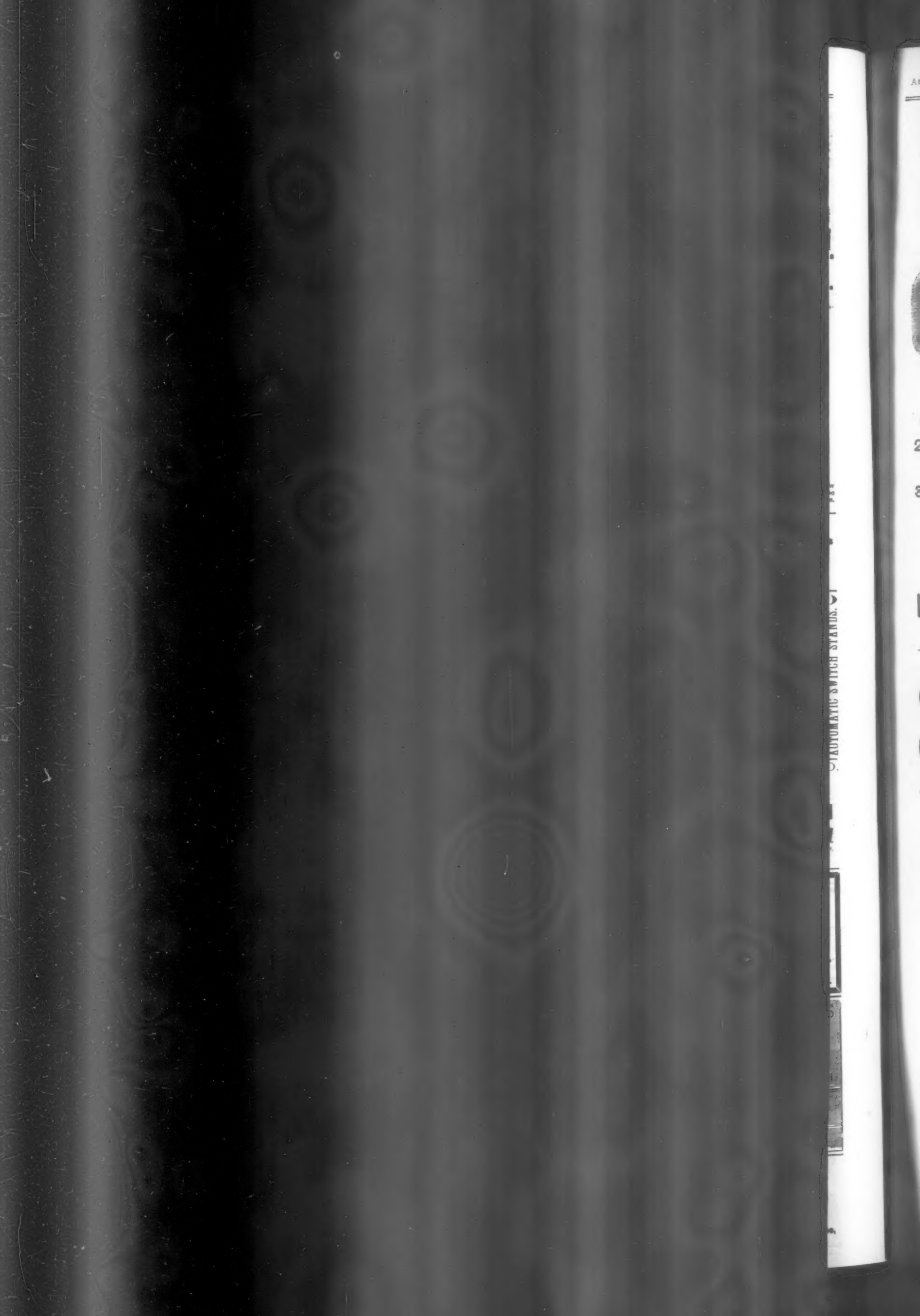
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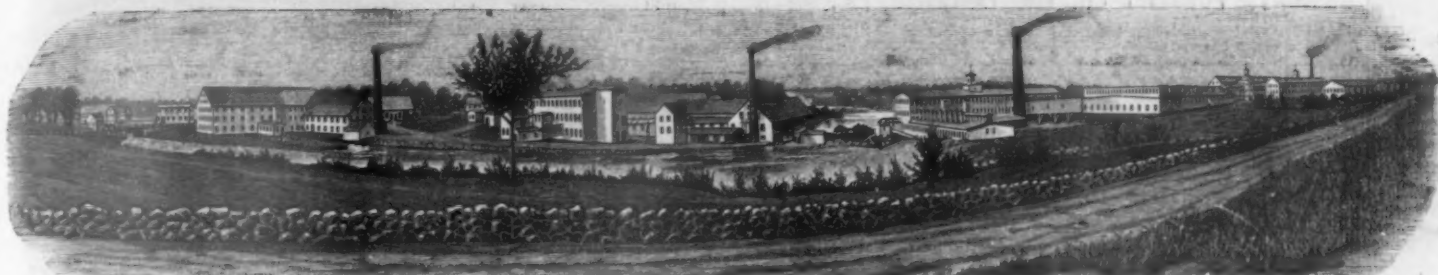
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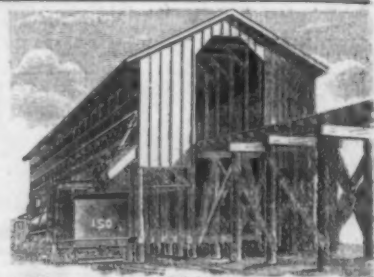
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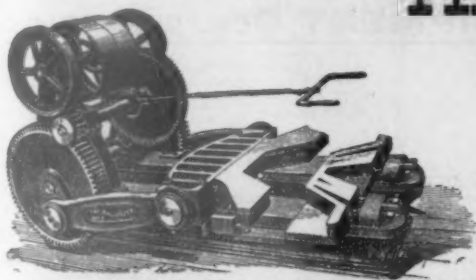
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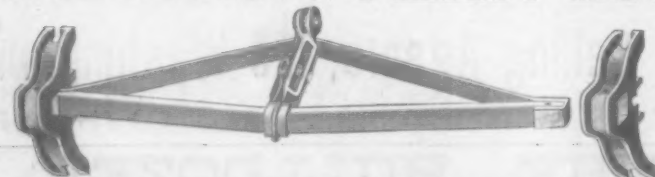
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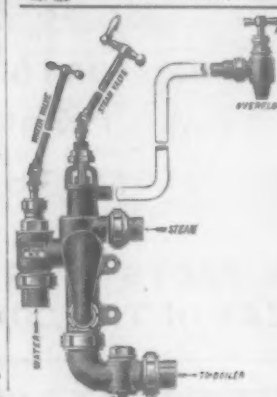
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